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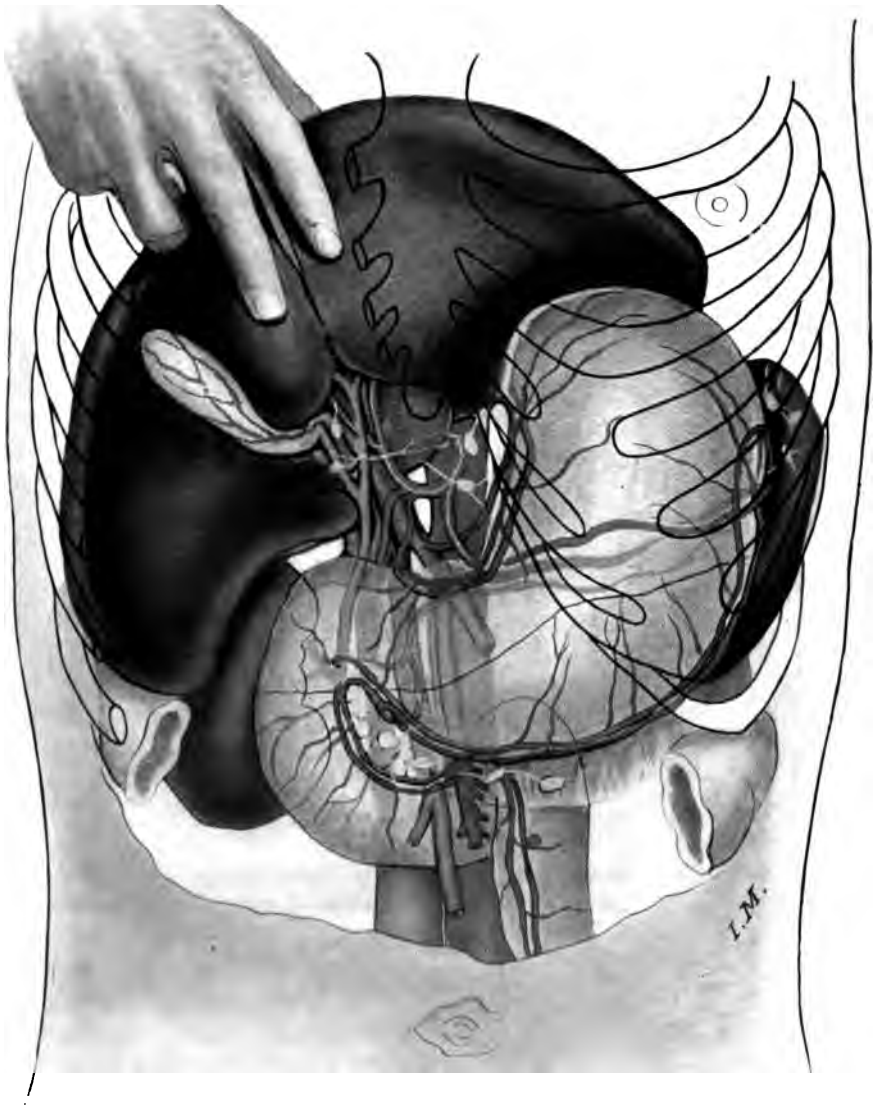

Showing the relation of the stomach to surrounding organs. Front of liver is raised so that under structure may be seen.

DISEASES OF THE STOMACH

AND

UPPER ALIMENTARY TRACT

BY

ANTHONY BASSLER, M.D.

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TO THE

PRACTITIONERS OF MEDICINE

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THIS VOLUME.

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PREFACE.

In the advancing of this volume it is not the purpose of the author to assist in the erroneous movement of divorcing the diseases of the stomach and upper alimentary tract from the field of internal medicine to which it rightfully belongs. Nor does he wish to approach the consideration of gastro-enterology by including it in the broader field, and thus add to these pages all of the subject matter found in text-books on the Principles and Practice of Medicine. In these more scientific days of our profession, ardent workers in the fields of physiology and nosology of the alimentary canal have elucidated much of practical value. My observations have coincided with some and been at variance with others; my experiences and thoughts have led me along a few modest lines of my own, and these, with some new personal contributions herein corporated, and the desire to write a handy work for the busy general practitioner of medicine, a book which is practical rather than charged with the discussions and the theories of different observers, are my reasons for the offering of this treatise.

To-day, the internist must recognize the fact that the wealth of detail necessary to bring the advances that have been made in this field of medicine to their best practical results means clinical observation, much laboratory labor, experience in the way of special technique in the examination and treatment of these conditions; a knowledge of practical chemistry, physiology, physiological chemistry, morbid histology; the medical uses of special drugs, baths, waters and electricity; the indications for surgery, some skill in the mechanical way, and so on. In the modern practice of caring for these diseases it requires more time than can usually be given to them by the busy physician who is engaged more generally, and thus is established only to a degree the propriety of this creed of internal medicine which is so indissolubly connected with the broader field that it can never be established as a branch apart as other departments are to-day.

Important indeed is it for one engaged in gastro-enterology to be versed in internal medicine and pathology, and it is the author's firm conviction that anyone who intends limiting his practice to this

field alone should first engage for some years in observation and experience in general medicine, or internal medicine at least. Because of the complexity of the work, unless he has had this broadening experience, the degree of success in his results will be seriously handicapped. To one doing much gastric work this is a fact that recalls itself each day to the broad-minded observer.

To be able to make an early diagnosis of gastric carcinoma before the tumor is palpable from without, a possibility that comes in the work now and then; the diagnosis and beneficent results obtained in the treatment of the chronic gastrides; motor, secretory and sensory disturbances of the stomach; conditions of the orifices; ulcers and so on, not to mention the still more ample field of the enteric tract with its accessory organs is worthy of a life's study. The privilege of life is short in years, experience is often fallacious, and in medicine much of the grain of practical worth is served with the chaff.

It is also true that the gastro-enterologist should observe concerning the dyspeptic who has walked into his office or clinic, and whose case proves to belong to the category of the circulatory, respiratory, renal, nervous, infectious, blood, lymphatic, muscular or constitutional diseases, that there may be other hands more skilled than his are in at least the therapy of these conditions, and into these hands such a case might best be delivered. With the mutual understanding and observance of this, the gastro-enterologist's work can go pleasantly on as a specialty of internal medicine just as neurology is to-day, and in this way greater benefit can be brought to a patient and the noble art of medicine advanced.

The author wishes to express his appreciation and thanks to the following-named gentlemen for the various courtesies which they have extended to him in the preparation of this volume: Dr. E. E. Smith, Dr. H. Brooks, Dr. W. J. Bedell, Dr. S. R. Blatteis, Dr. F. B. Mallory, Dr. H. E. Robertson, Dr. G. R. Satterlee, Dr. L. J. Rhea, Dr. G. E. Pfahler, Dr. C. Jackson and Dr. A. W. Crane.

ANTHONY BASSLER.

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CHAPTER I.

Topographical and Histological Anatomy.

MOUTH.

THE process of digestion in the human being begins in the mouth. In this cavity the foods undergo certain mechanical and chemical changes which are important for the proper digestion of them.

The mouth, oral or buccal cavity, is the commencement of the alimentary canal. It is made up in the space between the upper and lower jawbones, with their alveolar processes and teeth, into a nearly oval-shaped cavity by the surrounding soft parts; lips in front, soft palate above, and fauces and pharynx in the back.

The lips are the two fleshy folds which surround the orifice of the cavity. They are composed externally of integument and internally of mucous membrane, between which are found the orbicularis oris muscle, the coronary vessels, nerves, considerable areolar tissue, fat, and the labial glands which empty through small orifices upon the mucous membrane. In structure these pea-sized glands resemble the larger salivary.

The cheeks complete the side walls of the mouth. In composition they are like the lips, excepting they contain a much larger quantity of muscle, fat, areolar tissue, vessels and nerves. The buccal glands resemble the labial, excepting they are smaller. Two or three larger sized ones are found between the masseter and buccinator muscles and, because their ducts open opposite the last molar teeth, they are called molar glands. The muscles entering into the structure of the cheek proper are, the buccinator, the zygomatici, the risorius santorini, and the platysma myoides. These, however, are not the most important muscles concerned in mastication.

The tongue is the organ of the special sense of taste. It is composed mostly of muscular fibers running in various directions, thus making the organ possible of a wide range of movement. In the middle line is a fibrous septum which divides the tongue into two symmetrical halves. The muscular structure, which has interposed much fat and the vessels and nerves, is divided into those muscles which take their origin external to the tongue and terminate in the substance of the organ (extrinsic)—the styloglossus, the geniohyoglossus and part of the superior constrictor of the pharynx; and the

muscles which are contained entirely within the tongue and form its greatest bulk (intrinsic). The posterior fibers of the geniohyoglossi muscles draw the tongue forward so as to protrude the apex from the mouth, and the anterior fibers draw it back again. The whole length of these fibers acting together depress the center of the organ forming the channel along which fluids pass backward in the act of sucking. The hyoglossi depress the tongue and draw down its margin rendering it convex from side to side. The styloglossi draw the tongue upward and backward, and the palatoglossi draw the base upward. The intrinsic muscles make possible the various smaller movements of the organ itself, completing the equipment for its functions in mastication and in the production of voice.

The vessels of the tongue are the arteries derived from the lingual, facial and ascending pharyngeal. The veins accompany these. The glands are the mucous, which are distributed over the surface of the mucous membrane, and resemble the labial and buccal; the serous, which are found in the back of the tongue and empty a water secretion near the taste-goblets and into the fossæ of the circumvallate papillæ; and the lymphoid follicles, which are found mostly in the space between the epiglottis and the circumvallate papillæ.

The nerves of the tongue are the hypoglossal and the inferior lingual branch of the chorda tympani. Sympathetic filaments pass from the nervi molles on the lingual and the other arteries that supply it.

The special nerves are the lingual branch of the glossopharyngeal (ninth cranial), and the lingual nerve a branch of the inferior maxillary (fifth cranial). The lingual supplies the anterior two-thirds of the mucous membrane of the tongue, the glossopharyngeal the posterior one-third. The taste-fibers are carried in these two nerves. In the case of the lingual they are derived from the chorda tympani, which is a branch of the seventh cranial. These nerves will be described more in detail in connection with the sense of taste.

The structures covering the tongue are peculiar to the organ. On the under surface is the continuation of the thin, smooth structure that lines the rest of the oval cavity. That on the dorsum, in addition, consists of a layer of connective tissue (corium) which supports the papillæ and over which is a scaly, tough variety of epithelium. In this connective tissue are found many vessels and nerves supplying the papillæ together with large plexuses of lymphatic vessels and glands.

The papillæ are cone-shaped projections of the corium containing one or more capillary loops amongst which are distributed nerves in

great abundance. According to their configuration they are designated as the circumvallate, fungiform and filiform. The circumvallate papillæ, from eight to twelve in number, are situated at the back of the dorsum of the tongue in a single row, obliquely arranged on each side so as to meet in the middle line. This apex is usually made up by the largest papilla of the group. They are about $\frac{1}{15}$ of an inch wide and surrounding them is a cup-shaped depression of mucous membrane. The fungiform papillæ are more numerous than the preceding and are scattered discretely and irregularly over the sides and dorsum. They are normally of a deeper color (due to their thin epithelial coating and vascularity), and further can easily be distinguished from the small variety by their larger size and shape (fungiform). Occasionally, when the tongue is moderately coated so that the filiform variety cannot be seen, the fungiforms stand out as deep red spots. The filiforms are generally distributed over the anterior two-thirds of the tongue. They are very small, are arranged in rows, and have numerous filiform processes projecting from their apices which are of a somewhat whitish tint.

Buried in the epidermis of the circumvallate papillæ and in some of the fungiforms, as well as elsewhere about the mouth, epiglottis and larynx, are the taste-buds which are generally recognized as the end-organs of the taste-fibers. These curious structures are oval bodies with an external layer of tegumental cells, and they contain in the interior a number of elongated cells each of which ends in a hair-like process which projects through the central pore to the free surface. These cells may be considered the true sense-cells and the ciliated ends, no doubt, act in some way to convey stimulation to them. When the cells are thus aroused, they affect the taste-fibers of the nerves which terminate in filaments around them.

The Teeth.—Among the mammalia, and particularly in man, the teeth are developed in two sets; the temporary or milk teeth, ten in each jaw; and the permanent teeth, thirty-two in number, also equally divided above and below. As the temporary teeth are not of much significance in this connection and they fall out early in life they will not be considered.

The full set of permanent teeth in each jaw consists of the four incisors, called so because they divide the food; the two canines, larger in size, so named because they resemble like teeth in the dog; the four premolars or bicuspids, named thus because of their position in front of the molars or from the fact that they have two cusps to assist in the cutting and grinding of the food; and the six molars, which are larger than the others, and which comminute the food.

Each tooth consists of a crown and root with the neck between. The bulk of the tooth is made up of a bone-like substance called dentine through which run numberless tubules from the covering of the crown (enamel) and the cement investment of the root (crusta petrosa) to the pulp cavity in the center of it. Through these exceedingly small canals ($\frac{1}{4500}$ of an inch in diameter) circulate the fluids that nourish the tooth. In the live tooth this circulation is carried on outwards from the pulp, which consists of connective tissue richly supplied with nerves and vessels; and in the so-called dead tooth only from the cementum inwards.

The enamel covering the crown is the hardest substance in the human body. It is thickest on the grinding surface and consists of a congeries of minute hexagonal rods (about $\frac{1}{5000}$ of an inch in diameter) which lie parallel with one another. The cement covers the fang of the tooth, gradually becoming thicker toward its extremity. It contains lacunæ and canaliculi like bone. Externally it is covered by the dental periosteum which supplies it and the tooth-substance with nutrition and serves to fasten it in the receptive spaces in the alveolar processes of the maxillary bones in which the teeth are held. In old age the cement increases in thickness, becomes irregular, and further conversion-changes in the dentine and pulp may fill up the pulp cavity with a hard substance which is intermediate in structure between dentine and bone.

The gums are composed of a dense fibrous tissue, closely attached to the periosteum of the alveolar processes, and surround the necks of the teeth. They are covered by a smooth, very vascular mucous membrane, which is remarkable for its limited sensibility.

Because of the importance of the teeth in the process of digestion it would not be amiss, in this connection, to spend a few moments on a few practical considerations of them from a dental standpoint.

The common and most destructive disease of the teeth is caries. It may be confined to one or more teeth as a slow process, but it may also involve every one of them at about the same time and be rapid in its course. It usually begins on the side of the dentine at the site of some imperfect point in the enamel, and it proceeds inward toward the center of the tooth in an enlarging cone-shaped progress. No portion of the crown or neck of the tooth is exempt from this disease which, if unchecked, destroys the entire crown leaving the root intact. In well-formed, firm teeth the process is slow and *vice versâ*. The profuse administration of mercury, the continued fevers, and all severe acquired and hereditary constitutional disorders are predisposing causes to this decay. The exciting causes are the agents which chemically disintegrate the enamel and dentine. These are derived from the abnormal secretions of the stomach (acids), saliva, mucus and the decomposition of animal and vegetable foods

in the mouth, certain vegetable acids in foods and drink (cetric, malic, acetic), medicines containing free mineral acids, and the fungi of the mouth. To prevent caries the teeth and mouth should be kept clean by washing after the meals, by freeing them from calcareous deposits, keeping the gums healthy and the secretions of the mouth normal in character by the use of a brush, waxed floss silk and an alkaline dentifrice. Carious spots should be recognized early, the cavity cleaned out and properly filled with suitable material by a dentist.

When the permanent teeth begin to erupt it should be observed that they come in regularly and in proper alignment. Here an experienced and painstaking dentist can do much good work in correcting irregularities by mechanically encouraging growth in various directions.

The diseases of the gums, such as sponginess, gingivitis, Rigg's disease, tumefactions, chronic inflammations, and simple ulcerations should be taken in hand early and cared for.

From the canines back to the end molars, wherever a space exists from the loss of one or more teeth, artificial teeth should be installed either as caps, bridge work or plate work. The teeth in the sides of the jaws are used for the grinding of the foods in mastication, and unless the alignment of them is complete and there are corresponding teeth above and below to coaptate, the comminution and insalivation of foods may not be sufficient for comfortable digestion. The loss of teeth and the absorption of the alveolar process of the inferior maxilla make this a common cause of gastric disturbance in the aged.

The salivary glands are three in number on each side—the parotid, the submaxillary, and the sublingual. They are of the compound tubular variety. The parotid is the largest of the three on each side, and it lies immediately below and in front of the external ear communicating with the mouth by a large-sized duct (Stenson's duct) which runs directly forward from the gland and opens on the buccal side of the cheek opposite the second molar tooth of the upper jaw. The gland weighs about three-quarters of an ounce, and its secreting epithelium is composed of cells which contain numerous fine granules. Its secretion is thin and contains considerable serum-albumin.

The submaxillary gland is situated below the lower jaw in the anterior part of the submaxillary triangle of the neck. It weighs about two drams and its duct (Wharton's duct) opens into the mouth cavity at the side of the frenum of the tongue. Its secretion is thicker than that of the parotid, containing more mucus.

The sublingual is the smallest of the salivary glands. It is situated immediately beneath the mucous membrane of the floor of the mouth at the side of the frænum linguæ. It is almond-shaped and weighs about a dram. It opens into the mouth cavity by from eight to twenty separate small ducts (ducts of Rivini) one or more of which opens into the duct of the submaxillary (duct of Bartholin).

Its secretion contains much mucus and is the thickest of the three true salivary glands; this is no doubt due to the presence in the gland of a predominance of the mucus-secreting cells.

In addition to the salivary glands numerous other small-sized glands are found in the mouth. They are scattered on the posterior part of the dorsum of the tongue back of the circumvallate papillæ, at the margins of the tongue, in the tonsils, soft palate and in the buccal walls and lips. They secrete mucus which keeps the mouth moist during the intervals of mastication, and which when mixed with the salivary secretion assists in swallowing. Those, however, which open into the trenches about the circumvallate papillæ secrete a more watery fluid, which Ebner believes assists in the sense of taste at this point.

The salivary glands possess definite secretory nerves which are derived from the chorda tympani (Ludwig). These fibers terminate in a plexus upon the membrana propria of the alveoli, and from this plexus fine fibers pass to the secreting cells. These nerves probably also carry filaments from the sympathetic.

The cells of both the albuminous and mucous glands undergo histological changes during activity. According to Langley, when in a fasting condition the cells have a granular appearance throughout their structure and the border lines of the different cells are faintly marked with light lines. When the gland secretes, the granules begin to disappear from the edges of the cells, so that each cell shows an outer clear and an inner granular zone. If the stimulation continues the clear zone increases in extent and the cells become smaller. It is assumed that the granules are employed in some preparatory way to make the main organic constituent of the secretion (ptyalin), and that these granules form in the resting glands during the intervals of salivary discharge; thus they are spoken of as zymogen granules.

The cells in the mucous glands also undergo a change during secretion. In stained sections of the resting gland the cells are large and clear with flattened nuclei near the base of the cell body. When the glands are made to secrete, the nuclei become more spherical and lie more toward the middle of the cell, while the cells themselves become distinctly smaller. Langley has shown that the cells of the submaxillary glands contain numerous large granules. As these granules can be favorably compared with those in the mucus-secreting goblet-cell it can be inferred that they consist of mucin, or some preparatory substance, which is extruded from the cells and glands during secretion.

PHARYNX AND ESOPHAGUS.

The pharynx is the musculo-membranous, funnel-shaped sac, arger above than below, that extends from the under surface of the skull to the esophagus, which it joins at the cricoid cartilage in front of the level of the sixth cervical vertebra. In the adult it is about four and a half inches long, and is widest in its transverse diameter. It is composed of three coats, of which the internal mucous is soft, red and contains many mucous glands. This membrane is continuous above with that lining the Eustachian tubes and the posterior nares, and is covered by ciliated columnar epithelium. Below the nares, however, this epithelium abruptly changes in character into the squamous form which lines the rest of the cavity.

The fibrous coat gives strength to the pharynx, serves to attach it above to the occipital and temporal bones, and by its median raphæ gives attachment to the constrictor muscles.

The muscular coat includes the superior, middle and inferior constrictors, which muscles are concerned in deglutition. When this is about to be performed, the pharynx as a whole is drawn upward and dilates to receive the bolus. As soon as the morsel is received in the pharynx the bag descends, the constrictors contact upon it conveying it downward into the esophagus. The pharynx also acts as part of the respiratory canal and in the modulation of the voice, especially in the production of the higher tones.

The esophagus, or gullet, is a muscular canal about 23 centimeters (9 inches) in length extending from the pharynx to the cardia of the stomach. It commences at the upper edge of the body of the sixth cervical vertebra, descends in front of the spine through the posterior mediastinum, then through an orifice in the diaphragm between the left vertical edge of the bodies of the vertebra and the central tendon, and terminates at the cardia opposite the tenth dorsal vertebra. At its commencement, it is in the median line from which it inclines to the left down to the root of the neck where it again passes to the median line and finally deviates for the second time to the left as it passes forward to go through the diaphragm. Its course also corresponds to the natural flexure of the spine. It is the narrowest part of the alimentary canal, and is smallest at the two ends.

It has three coats—an external muscular; a middle or areolar; and the internal or mucous.

The muscular coat is made up of two layers of muscular fibers, mostly of the striped variety above, and the involuntary below. The fibers of the external layer run longitudinally; the internal, circular

above and obliquely below. Between them are found groups of ganglion cells in plexus formation and small vessels.

The areolar coat loosely connects the muscular layers with the mucous membrane. It supports the bodies of a number of small racemose glands, and a plexus of nerves which connect with those between the muscular planes.

The mucous coat lines the tube. It is thick, of a reddish color above and much paler below. It is disposed in longitudinal folds which disappear on distention of the tube. It contains numerous papillæ, some muscular fibers, the ducts of the glands in the areolar coat, and a thick layer of stratified epithelium.

It is important to note that the epithelium lining the entire upper alimentary canal, from the lips to the cardia, is of the stratified squamous variety. In the upper respiratory half of the pharynx are found the stratified ciliated columnar variety with some goblet-cells.

The nerves of the esophagus are branches from the pneumogastric and sympathetic. Its arteries are derived above from the thyroid axis of the subclavian, in the middle zone from the descending aorta, and below terminals from the gastric branch of the celiac axis of the abdominal aorta. For the most part these arteries, with their veins, run in a longitudinal direction and anastomose with each other.

THE STOMACH.

The stomach in man is single; in some of the ruminating animals it is compound. It is situated between the lower end of the esophagus and the beginning of the first part of the duodenum, and is the widest part of the alimentary canal. As an organ, it is conically shaped, presenting its largest end (fundus) to the left, and the smallest part (pylorus) to the right. It is situated high in the left of the abdominal cavity occupying with the spleen practically all of the confines of the left lower ribs below the diaphragm. In the abdomen it lies in the left hypochondriac, epigastric, and occasionally in a small part of the right hypochondriac regions, and in the author's observation, when of normal size and position and when standing, in the umbilical region down to the umbilicus. It is bounded above by the diaphragm and liver; below, by the small intestine and transverse colon; in front, by the false ribs and anterior abdominal walls; on the left, by the ribs; on the right, the pyloric end reaches to the gall-bladder; and in back, by the spleen, pancreas, left kidney and its suprarenal body. The fundus end is covered by the lower part of the left lung and its pleura, and the left lobe of the liver somewhat covers

the pyloric region in front. From the fact that the fundus and the lesser curvature are quite invested (left lung and left lobe of the liver), palpation of these regions for tumors is rendered impossible, unless the stomach has descended (gastroptosis).

The stomach is maintained in its position by a ligamentous attachment at the cardia; at the pylorus by the descending portion of the duodenum which is fixed to the spine, and also by the lesser omentum and its suspensory ligaments, which are all parts of the peritoneum. From the diaphragm to the cardia is a special fold known as the gastrophrenic ligament, which is the most fixed point of the stomach proper. The pyloric extremity and the greater curvature are the most movable parts of the organ. The lesser omentum fills in the space between the phrenosplenic ligament on the left. The anterior and posterior surfaces are covered by peritoneum. From the greater curvature of the stomach falls the apron of the greater omentum, which is continued on in the transverse mesocolon. In the author's opinion (also Moritz and Hemmeter) intra-abdominal pressure under ordinary conditions is not a factor in the support of the stomach.

The arteries of the stomach are the gastric, the pyloric, the right gastro-epiploic and vasa brevia from the splenic. These vessels pass to the stomach in the region of the curvatures and pass through the musculature; mostly at right angles to the submucosa, in which structure they run in larger trunks longitudinal to the organ. From these, vessels are sent into the mucosa, which, immediately after they pass through the muscularis mucosa, spread out in numerous fork-like branches; from these fine branches is formed a capillary mesh which surrounds the tubules. From these capillaries the veins arise, but they are formed mostly from a fine-net venous plexus situated high in the mucosa. These venous capillaries pass to a second and coarser transverse plexus which embraces the muscularis mucosa, and from here the venous blood empties into larger-sized, sacculated trunks in the submucosa, from which in smaller vessels the blood passes through the muscularis and without the organ. The arrangement of the vessels is such that about two-thirds of the blood sent into the organ goes to the mucosa. The arrangement of the lymphatics is much the same as the veins.

The nerves are supplied from the right and left pneumogastric, the former being distributed upon the back and the latter upon the front part of the organ. A great number of branches from the abdominal sympathetic (solar plexus) also supplies the walls of the organ.

The stomach varies considerably in size. This depends upon the degree of distention, the height of the individual (larger in tall persons), sex (smaller in women), and the age (larger in old persons). When filled, the adult stomach in its largest diameter (longitudinal) measures from 25 to 30 centimeters, its widest transverse from 8 to 10 centimeters, and at the pylorus from 2 to 5 centimeters. When empty, it is about one-third smaller in its longitudinal axis, slightly so in its transverse, and the space at the pylorus is obliterated by the folds of the mucous membrane coming in contact. The capacity of the stomach, according to Ewald,[1] varies between 250 and 1680 cubic centimeters. He considers a capacity of 1600 to 1700 cubic centimeters as the normal limit.

For the purpose of location, the stomach is divided into the cardia, the fundus, the body or intermediate region, the antrum pylori or

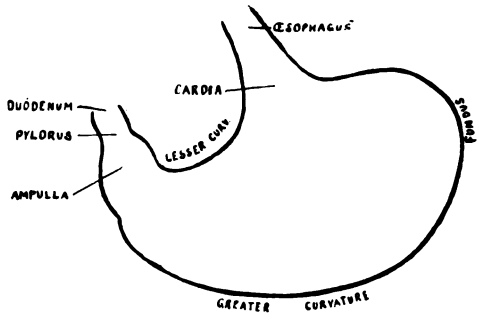


Fig. 1.—Outlines of the normal human stomach.

ampulla, the pylorus, and the lesser and greater curvatures. The antrum pylori is divided from the body by a line of separation marked by a fissure on the small curvature called the incisura angularis, and by an abrupt turn upward in the large curvature (His[2]). This pyloric separation is an important point; for the reason of the angle that the pyloric region makes with the body, the difference in the musculature, the macroscopic and microscopic characteristics of the antrum mucous membrane, and the fact that there is a functional difference between these two parts of the stomach.

The cardia marks the site of the joining of the esophagus with the stomach. It is somewhat funnel-shaped with the large end downward. The esophagus is inserted in the stomach between the fundus and the lesser curvature, at a point about 2 centimeters below the diaphragm. The cardia is situated slightly to the left of the median line at about on a level with the left edge of the ensiform process of

the sternum. As it is deep and completely covered by the left lobe of the liver, cardiac growths cannot be palpated (unless under exceptional conditions of prolapse). The fundus is the largest part of the stomach and extends to the left of the cardia. Its upper limits, about 5 to 8 centimeters, marks the highest point of the organ and this is about on a level with the costal cartilage of the fifth rib in the maxillary line. It is intimately connected with the diaphragm by means of a reflection of the peritoneum which passes from the abdominal surface of the diaphragm. It lies under the cover of the ribs and is connected posteriorly to the spleen by the gastro-splenic omentum. The pyloric end, the smallest part of the stomach, is situated on a plane anterior and inferior to the fundus in the right sternal line and about 5 centimeters below the tip of the ensiform. At the pyloric orifice it joins the duodenum at which site there is a valve-like formation of muscular fibers (the pylorus). The pylorus is higher and posterior to the ampulla and lies upon trunks of the portal vein and the hepatic artery. Of importance from a practical standpoint are the courses of the two curvatures. The greater curvature extends downward from the fundus into the left hypochondrium, and descends into the abdomen in a continued convex line from the junction between the ninth and tenth ribs to a point (prone position) in the median line about 2 centimeters above the umbilicus in women, and 3 centimeters in men. From here it rises upward to the right, passes beneath the liver to the front of the median surface of the gall-bladder and terminates at the pylorus. The lesser curvature runs from the cardia to the pylorus, extending in a curved line downward and slightly inward, in about the left line of the bodies of the vertebra. Then, in the neighborhood of the first lumbar vertebra, it makes a sharp turn to the right of the median line and continues a course fairly parallel to the greater curvature to form the upper part of the pylorus. It is covered and connected to the under surface of the left part of the liver and (important to note) is covered by the anterior margin of the left lobe of this organ.

The normal stomach presents a wide range of differences in its size, position and connections. When distended, the greater curvature is elevated and carried forward so that the anterior surface turns upward, the posterior downward and the entire organ presses forward against the abdominal wall. At the same time the fundus pushes the diaphragm upwards, contracting the chest cavity and displacing the heart; hence the symptoms of dyspnœa, asthma, palpitation, changes in the pulse, and precordial distress complained of in gastric disorders. When empty, it lies against the back of the abdomen

removed from the front walls. On deep inspiration it descends to or a little below the umbilicus; and on expiration it ascends again. On contractions of the abdominal muscles, such as in straining at stool, vomiting and retching, the pyloric end and part of the body ascends, but the fundic extremity remains quite fixed.

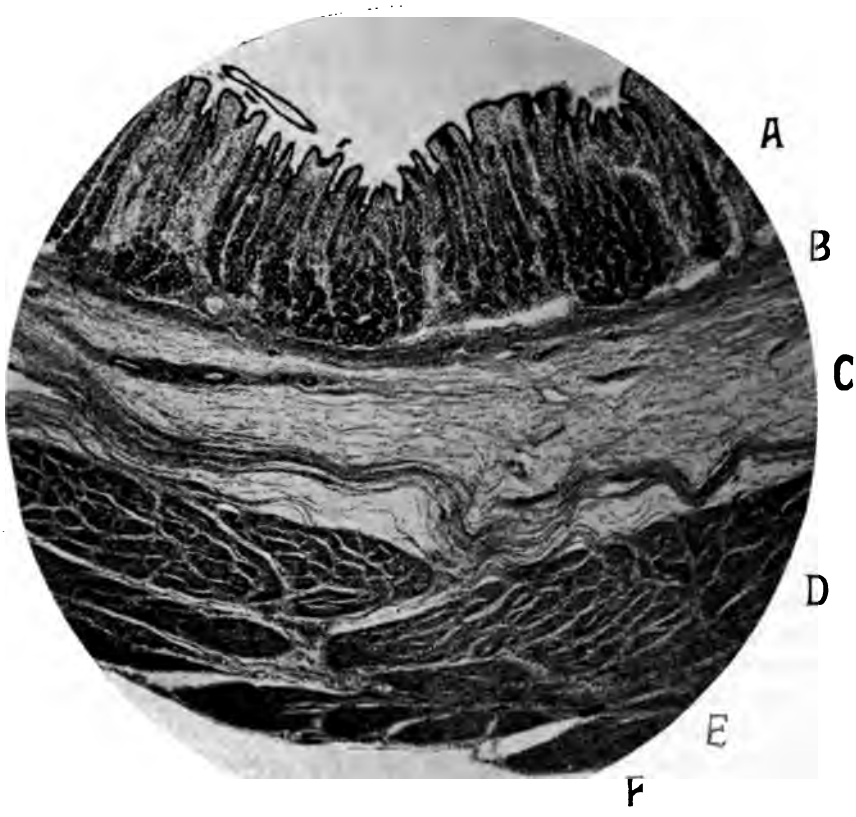
The stomach consists of four layers of component structures—the glandular, the areolar, the muscular, and the serous.

The glandular layer, tunica propria, or erroneously called mucous membrane (because its form of structure and function are to

Fig. 2.—Photomicrograph of the epithelium of the normal human stomach, showing the columnar cells which line the organ and the infundibula of the gastric tubules. In the connective tissue on each side of the center are seen portions of the gastric tubules. × 800.

secrete gastric juice rather than mucus), is divided on its free surface into a large number of lattice-like, polygonal, or hexagonal folds by slight ridges. This honey-combed appearance (Etat mammelone) is made to provide for a very rich glandular apparatus. At the bases of the alveoli, which vary from $\frac{1}{100}$ to $\frac{1}{300}$ of an inch in diameter, are seen the orifices of the gastric tubules which are situated perpendicularly side by side throughout the entire glandular membrane. The membrane itself is soft and pulpy and of a pinkish-gray color; during gastric digestion, because of the greater quantity of blood in

PLATE II.



Photomicrograph of a vertical section of a human stomach showing the component structures. *A*, The tunica propria or the glandular layer. *B*, The muscularis mucosa. *C*, The submucosa. The foregoing structures comprise the mucosa. *D*, The circular muscular fibers. *E*, The longitudinal muscular fibers. These comprise the muscularis. *F*, The peritoneum or serous layer. × 30.

the superficial plexuses around the alveoli, it becomes a much deeper red. It is thickest at the pyloric and thinnest at the fundic end. From left to right run larger ridges (rugæ) which flatten out when the organ is distended.

The epithelium covering the membrane and down into the ducts of the glands is of the columnar variety. The cardia marks the end of the squamous type found above; and throughout the stomach and intestines the lining cells are cylindrical in form. Aside from these cells recent investigations have shown the presence of a type of cell with a cuticular border line like those found commonly in the intestines. In the locations where these cells are found are also found the cup-shaped goblet or beaker-cells, which at one time were considered as formed by a pathological inclusion of mucus in the cylindrical cells separating the cell-body in the center; Ad. Schmidt,[3] and P. Hari[4] have proven them to be normal cells. Boas[5] divides the cylindrical cell-body into the superficial or mucous portion and the basal or protoplasmic portion; in the latter is situated the nucleus. These cells secrete gastric mucus and during the process of secretion these two parts of the cell stain differently.

The main bulk of the glandular layer is made up by the gastric glands or follicles. These tubules lie side by side, with usually from four to sixteen openings into the base of a common exit for all. According to Sappey, there are about five million of these follicles in the stomach. These tubules extend from the pits of their alveoli to the muscularis mucosa, a thin layer of unstriped muscle-fiber at their bases and the contractions of which serve to express the contents of the follicles during digestion. Just above this muscular layer the glands are divided into numerous branches. At the fundus the glands are less numerous, shorter and more regularly placed, and are called the gastric or glandular follicles. As they approach the pylorus, and at it, they become more convoluted, coiled, more thickly set, are longer and are called the pyloric glands. At this location they form the transition from the simple follicle of the fundus and the body to the convoluted glands of Brunner which lie immediately below the pylorus (Watney). Thus two, and sometimes three, kinds of glands are distinguished—the fundic, pyloric and cardiac. The cardiac glands are found around the cardia and are not very definite (Haane[6]).

In their histological structure the glands present differences that doubtless prove that their secretions are different in different parts of the stomach. This is observed mostly in the variety of glands and number of three types of cells that are found in them, the cylindrical, the chief or central, and the acid or parietal.

The cylindrical cells line the pit of the gland and are a conti tion of those on the free surface. In the alveoli, however, they bec more cuboidal in shape and are shorter as the summit of the secre part of the follicle is reached. Here and there, in an irregu formation a short spear-pointed projection extends from some of cylindrical cells into the lumen of the duct.

The second type of cell, the chief or central, is a pyramidal irregularly cuboidal cell with a finely granular protoplasm and a w defined dark staining nucleus situated near its proximal border. T

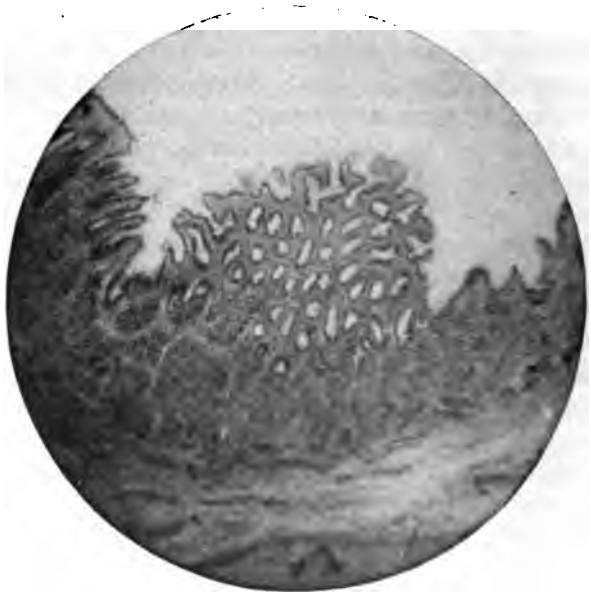


Fig. 3.—Section through the glandular layer of the pyloric region of the human stomach, showing the openings of a number of glands and the less regular arrangement of the gastric tubules than is found in the body or fundus of the stomach. × 70.

protoplasm of these cells stains very poorly with the aniline stain and does not show a well-defined body even in the fresh state. Occa sionally in atrophic gastritis these cells can be made out in the was water (Bassler[7]). Heidenhain has shown that they are almost clea and transparent in the fasting state, and that they become somewha cloudy and granular during digestion. They are held to be th sources of the pro-enzymes, pepsinogen and rennin zymogen, and the are the preponderating cell in the stomach.

The acid, parietal, or oxyntic cells, are found in fewer numbe than the above, and are usually situated between the central cells ar

the frame structure of the tubules (border cells). These are usually found rounded, oval-shaped or irregularly triangular with rounded bases. They take up aniline stains readily, display a well-stippled body (Bassler[8]), and a well-defined spherical nucleus about in the center of the protoplasm. They are found in largest numbers about the neck and upper part of the body of the glands, and in the fundic glands they protrude into the lumen of the tubules. Heidenhain believes that they are the sources of the hydrochloric acid content of the gastric juice, although Fränkel[9] and Klug[10] claim in addition

Fig. 4.—Photomicrograph of a transverse section through the gastric tubules of the normal human stomach about two-thirds the distance down from the infundibula of the glands. The rosette of cells in the tubules are the central or peptic cells. At the outer edges of these groups are plainly noted the larger parietal or acid cells. The lower half of the specimen is composed mostly of connective tissue. Stained with hematoxylin and eosin. × about 350.

that they assist in the elaboration of pepsinogen also. In the author's opinion this has a tenable basis, but only in the way of a direct stimulant to the activity of the other enzyme-producing cells. During digestion these cells swell quickly (likewise the central, but not to the same relative extent) and return to their original size shortly after the full secretion of gastric juice; while the central cells do not assume their former appearance and size for some hours afterwards.

It is well known that the glandular tubules of the pyloric region

contain only central cells (producing only ferments), while the gland tubules of the fundus contain both the acid and central. Heidenhain has shown that the secretion of the fundus (and no doubt to a less extent, in the acid way, those in the body) contain both acid and pepsin, while that from the pylorus was alkaline and contained only the proferments. It has been found by Golge that microscopic canaliculi extend from the acid cells (running between the central) into the lumen of the gland.

The areolar coat consists of loose, filamentous areolar tissue running longitudinally and connecting the glandularis with the internal muscular layer. It serves as a cushion for the glands and supports the blood-vessels previous to their distribution to the tubules (vascular coat). This coat also contains some elastic fibers, and here and there small collections of fat cells. It supports above the muscularis mucosæ which is composed of two or three layers of smooth muscle bundles which run in various directions giving off-shoots upward to the bottoms of the glands.

The muscular coat consists of three sets of unstriped muscle fibers—the longitudinal, circular, and oblique.

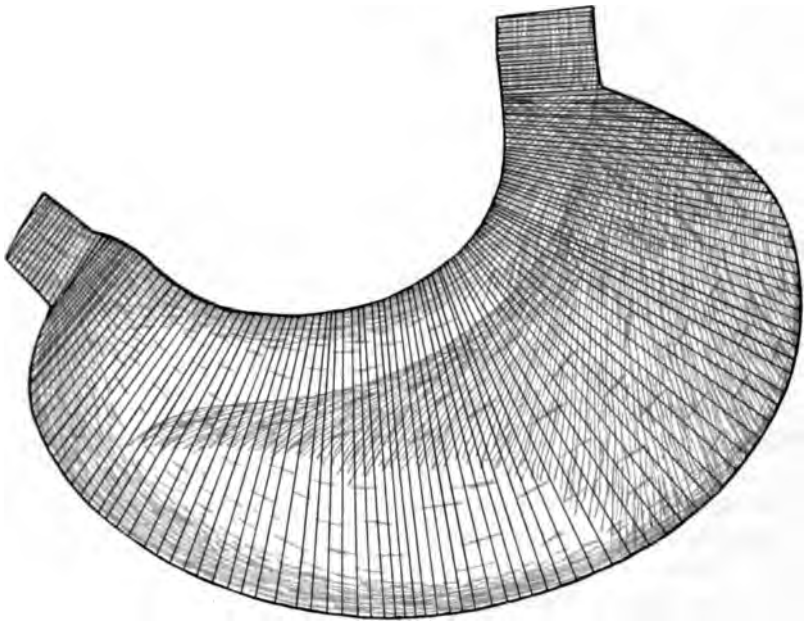
The longitudinal are the most superficial, and are continuous with the longitudinal fibers of the esophagus radiating in a stellate manner from the cardia. They are most distant along the curvatures, presenting a denser formation along the lesser. At the pyloric end they present a thickened band (ligamenta pylorica) from which they continue on into the longitudinal fibers of the small intestine.

The middle layer is composed of circular fibers which form a uniform covering over the entire extent of the stomach. At the pylorus they thicken forming the pyloric sphincter, and projecting into the lumen with a few fibers from the longitudinal, form, with a thickened fold of mucosa, the pyloric valve. The cardia has no distinct sphincter. Thus, the sphincter pylori is firmly contracted during digestion, but gas and fluids can readily escape through the cardiac orifice.

The oblique fibers are limited chiefly to the cardiac end of the stomach where they decussate in various directions in rather a thick layer around the cardia, making possible a tonic closing of this orifice. They are continuous with the circular fibers of the œsophagus and are the most internal of the three muscular planes.

The serous or peritoneal coat completely covers the outside of the stomach excepting for a triangular space at the lesser and greater curvatures through which the nutrient vessels and nerves run. Beginning at the under surface of the liver (the transverse fissure) and from

PLATE III.



Schematic figure showing the three layers of fibers which make up the muscularis of the human stomach. Yellow, the longitudinal (external). Black, the circular (middle). Red, the oblique (internal).

that to the left of the diaphragm and esophagus, the two layers of the lesser omentum pass downward to the lesser curvature. From this point they pass separately over the anterior and posterior surfaces of the stomach ending below in a long apron (greater omentum) which covers the front of the intestines and is reflected back to enclose the colon and form the transverse mesocolon which is firmly attached to the vertebral column. The back wall of the stomach is part of the boundary of the lesser peritoneal cavity; the front, part of the greater. This is an important fact to remember in connection with the early diagnosis of collections resulting from perforations of the stomach in the posterior wall.

THE INTESTINES.

The small intestine begins at the pylorus and terminates at the head of the large intestine. It is a continuous tube about 5.7 meters (twenty-two feet) in length which is thrown into many convolutions, occupies the middle and lower parts of the abdomen, and is widest at its beginning from which it gradually tapers down to its end. For the purpose of description it is divided into the duodenum, the jejunum, and the ileum.

The duodenum is the beginning 25 or 30 centimeters (ten or twelve inches) beyond the pylorus and is the widest and most fixed part of the small intestine. It describes a horseshoe course around the head of the pancreas and is divided into an ascending portion, which is freely movable (having part of the lesser omentum) and runs close to the liver and gall-bladder; a descending portion, which is firmly fixed to the vertebra and pancreas (peritoneum only in front) and ending at about the third lumbar vertebra in front of the right kidney and contains the orifice of the common bile and pancreatic ducts (ductus communis choledochus); and the last or transverse portion, which swings to the left from the descending at about the third lumbar vertebra, is the longest and narrowest part of the duodenum and is crossed by the superior mesenteric vessels (which exit between it and the under line of the pancreas which it closely adjoins), and finally it ends in the jejunum.

The Jejunum.—At the point where the small intestine receives a complete investment of peritoneum begins the jejunum. Its length corresponds to the upper two-fifths of the small intestine below the duodenum; the ileum, the lower three-fifths. Its convolutions are confined chiefly to the umbilical and left iliac regions. The jejunum is between the duodenum and ileum in size, is very vascular, and its walls are quite thick.

The ileum is very convoluted, and its coils lie in the umbilical, right iliac and sometimes in the pelvic region (enteroptosis). Its coats are thinner and not so vascular as those of the jejunum, and it joins with the cecum forming the ileocecal valve.

The large intestine continues the canal from the end of the ileum (cecum), ascends to the under surface of the liver and gall-bladder (ascending colon), turns to the left (hepatic flexure), runs a sagging transverse course across the abdomen a little above the umbilicus (transverse colon), turns downward beneath the lower edge of the spleen (splenic flexure), runs downward (descending colon) and finally terminates in the upper part of the rectum (sigmoid). It is about 1.5 meters (five feet) long and is much wider than the small intestine.

The small and large intestine, like the stomach, have four coats —the serous, muscular, areolar and mucous.

The external, or serous, is the peritoneal investment and serves the purpose of lubricating and keeping moist their external surfaces so as to facilitate their movements. The muscular coat consists of two layers—an outer longitudinal, and an inner circular. The circular fibers are the thicker and more distinct. Their purpose is to advance the contained foods onward by a vermicular and peristaltic movement: the circular fibers stripping the canal, while the longitudinal ones dilate and draw it upward over the passed chyme. There is a ganglionic plexus of nerve-fibers between the muscle layers in the small intestine (Auerbach's plexus), and a secondary plexus inside of the circular fibers (Meissner's plexus). The areolar coat joins the muscular to the lining membrane, contains the vessels before they pass to the glandular and absorbing membrane and a large network of lymphatic vessels, and the Meissner plexus of nerves.

The internal coat of the small intestine has a shaggy or velvety appearance due to the numerous villi which stud its surface. It is of a reddish color, deeper above than in the ileum where it is also the thinnest. It is lined by cylindrical epithelium, and at the alveolar ends of the glands is a fine plane of unstriped muscular fibers (muscularis mucosæ). The membrane supports small effaceable folds (rugæ) and permanent ones which cannot be obliterated on even extreme distention (valvulæ conniventes). These latter, the valvular conniventes, are crescentic projections placed transversely to the axis of the bowel. They serve to increase the absorption surface to which the food is exposed.

The villi, peculiar to the small intestine, are conical-shaped projections of the membrane of from 0.5 millimeter to 0.7 millimeter long.

They consist of a prolongation of the membrane, inclose a network of blood-vessels, one or more lymphatic vessels (lacteals), a few plain muscular fibers and a general building structure of lymphoid tissue. Filaments from the Meissner plexus form arborizations throughout their structure. An arterial twig from the areolar coat mounts a spiral course through them branching into a meshwork of capillaries at their exposed surface.

The lacteal radicle lies in the center of the villus with the small blood-vessels. Sometimes a villus contains two of these absorbing vessels but in the human being rarely more than that. The radicle

Fig. 5.—Section through the mucous membrane of an injected specimen of human intestine (jejunum), showing the villi with the central spiral vessels and the vascular mesh or cone. All the dark lines represent blood-vessels filled with the injection mass. × 70.

consists of a delicate layer of flattened epithelium with a few fine filaments of plain muscular fibers running longitudinal to them (Brücke). These fibers cause the interesting movements of the villi which, as Cannon has shown, are directly influenced by the emotions and sensations of distress and pain. In addition to the columnar epithelial cells of the villus, under which there is a large collection of leucocytes during digestion and absorption, are also found numerous goblet- or beaker-cells. These villus epithelial cells are the principal agents in the process of the absorption of food materials

from the gut. This is proved by the presence of fatty substances in their structure, although the other products of digestion (peptones, maltose and salts) have as yet not been conclusively proved to be present in them. Hemmeter[11] suggests that the large amount of lymphoid tissue in the lower part of the small intestine seems to be related to absorption in those locations.

Two kinds of true secreting glands are found in the intestines—the glands or crypts of Lieberkühn, and the glands of Brunner. There are also present two varieties of lymph follicles—the solitary, and the collected (Peyer's patches).

Fig. 6.—Photomicrograph of a section of one of the agminated glands (Peyer's) from the lower gut of a dog, showing the gland structure, the blind opening, and the follicular glands (Lieberkühn) in the mucosa. × 70.

The follicles or glands of Lieberkühn are tubular pits lined with columnar epithelium and they open between the bases of the villi. They are present throughout all of the intestines (large and small), and extend vertically through the depth of the mucosa. In the duodenum alone are seen an additional type of glands (glands of Brunner). These resemble those found in the pyloric region of the stomach, excepting that in the intestine they are more divided and sink deeper through the mucosa and often into the areolar tissue. They are of the racemose variety, and open either between the Lieberkühn follicles or into their bases.

The solitary glands are scattered throughout the entire intestine, and are found most abundantly in the ileum. The agminated glands (Peyer's patches) are large, oval lymph follicles, held together by adenoid tissue. They are found best developed in the ileum, where, if they are placed high in the areolar tissue, they cause a pitting of the mucosa.

The blood-vessels of the intestines follow the arrangement of those found in the stomach. They pierce the muscular coats, supply these tissues, then enter the areolar tissue or submucosa and form a wide-meshed network. Surrounding the follicles is a netting of fine capillaries, which, just beneath the epithelium, form a surface network from which the veins arise which collect to form larger-sized vessels in the submucous areolar tissue. The arteries of the small intestines are all the branches of the superior and inferior mesenteries. It has been computed that during digestion these, with those of the colon, are capable of taking up one-third of the blood in the human body.

The lymph vessels begin in the lacteals where they arise from a blind pouch in the summit of the villi. From here they descend in the septum between the glands to the lymphatic mesh over the muscularis mucosa. Here they join with larger vessels in the submucosa, and from this out begin to be supplied with valves. They continue through the muscular coats and then run between the two peritoneal layers of the mesentery to the receptaculum chyli, which is the lowermost point of the thoracic duct situated opposite the first and second lumbar vertebræ.

The nerves of the intestines are supplied from the mesenteric plexus of the sympathetic which plexus receives branches from the celiac plexus, semilunar ganglion, and also the pneumogastric.

References.

1 Ewald: Klinic der Verdaungskrankheiten, Theil 11, 3 Aufl., p. 86.

2 His: Archiv f. Anatomie, 1903, p. 345.

3 Ad. Schmidt: Deutsche Medizinische Wochenschrift, 1895, No. 19, S. 300.

4 Hari: Archiv für mikroskopiche Anatomie, 1901, Bd. 58, p. 678.

5 Boas: "Diseases of the Stomach," 1907, p. 8.

6 Haane: Archiv f. Anatomie, 1905, 1.

7 Bassler: "Significance of Wash-water Examinations for Gastric Cells in the Diagnosis of Atrophic Gastritis," Medical Record, June 11, 1908.

8 Bassler: Medical Record, June 11, 1908.

9 Frankel: Pflüger's Archiv, 1890, Bd. 48, S. 63.

10 Klug: Ungar. Archiv f. Medicine, 1892, Bd. 1, S. 35.

11 Hemmeter: "Diseases of the Stomach," third edition, p. 36.

CHAPTER II.

Physiology and Chemistry.

THE SENSE OF TASTE AND RELATIVE SENSE OF SMELL.

THE sense of taste acts as a guide to the individual in the choice of foods, lends to mastication a sense of pleasure, and reflexly stimulates the secretion of the saliva.

The end-organs of taste have a rather wide distribution. The most sensitive regions are the tip, the edges and the back portion of the tongue particularly around the circumvallate papillæ. The sense is also found present in the soft palate, epiglottis, and in the upper part of the larynx. In the latter location, it may be looked upon in the light of a protection to the entrance of foods or fluids into the larynx.

All authorities have agreed that the lingual nerve, a branch of the fifth cranial, supplies taste, as well as sensory fibers, to the anterior two-thirds of the tongue, and that the glossopharyngeal presides over the posterior one-third and the adjacent structures; but as to where these nerves obtain their special sense fibers is still debatable. It has been conclusively shown that the lingual obtains these fibers from the seventh cranial through its chorda tympani branch, and it is probable that those in the glossopharyngeal come through direct or from the ganglion petrosum high in its course. Some authors believe that the taste fibers of both nerves are supplied by communicating branches from the Gasserian ganglion of the fifth, but Cushing[1] as a result of the complete removal of this ganglion in thirteen instances proves against this contention. He has shown that in no case did the removal of this ganglion destroy the sense of taste in the posterior part of the tongue (glossopharyngeal). Thus we may believe that the taste fibers of this part go directly through the nerve and the petrosal ganglion into the brain with the roots of the nerve to terminate finally in its sensory nucleus in the medulla. He has also shown that the disturbance of the sense of taste in the anterior two-thirds of the tongue (lingual) following the removal of the semilunar ganglion was not a permanent condition. It would

thus seem that the older views of importance (in taste) given to the trigeminus and its ganglion were not entirely true, and that the fibers that course in the lingual from the chorda tympani run through the geniculate ganglion (seventh), and from this enter the brain with the fibers of the portio intermedia of that nerve as well as some fibers from the ganglion of the fifth; because a partial sense of taste may be present in paralysis of the seventh.

It has been shown that the appreciation of bitter substances is most marked at the back of the tongue; sweet and salty substances at the tip; and acids on the border. That the possibility of the appreciation of these tastes is not confined solely to these locations can easily be proved by personal experiment with different tasting solutions.

It is of some importance to remember that the sense of taste can be stimulated by substances dissolved in the blood (sweet taste in diabetes and bitter taste in jaundice), by gases and fluids regurgitated from the stomach (abnormal gastric fermentation, gastric stagnation, hyperchlorhydria, gastroduodenal catarrh). The conditions of the general body or the tongue itself may impair or render absent the taste-sense (ageusia). This may be noted in convalescence from the continuous fevers, in paralysis of the glossopharyngeal and facial nerves, trigeminal disease, basal meningitis, hysteria, tumors, injuries, and the catarrhal changes in the mouth incident to coryza, polypus and atrophic rhinitis. In the debilities and nose affections (sometimes in hysteria) it is usually bilateral and general. Purely subjective perversions (parageusia) are strongly suggestive of hysteria, but may be hallucinations of the insane or an aura of epilepsy. Certain drugs, such as the bromides and iodides, may also give rise to abnormal taste sensations.

That the sense of smell plays an important part in the taste of substances taken into the mouth is a matter of daily observation in the use of condiments and the character and preparation of foods an individual employs. The olfactory sense was spoken of by Kant as "taste at a distance," and there is no doubt that the desire for and zest of certain food-substances are materially enhanced in this way, and that these odorous attributes are of considerable value in the practical way in the feeding of the undernourished. Much of the flavor of fruits, the bouquet of wines, certain vegetables, skilfully savored purées and sauces on meats, and so forth, lose much of their zest when taken with the nostrils held. Time and time again in practice, it has been proved desirable to relieve recovering patients from the ennui and tastelessness of a hospital menu, and sometimes even a change from their own home cooking by placing them under different conditions.

MASTICATION, INSALIVATION, DEGLUTITION, AND BUCCAL SECRETION.

Mastication is an entirely voluntary act although it usually takes place in a habitual way without the exercise of the will. The rather loose articulation of the lower jaw with the skull permits of a wide

variety of movements, and in the production of these, the masseter, temporal and internal pterygoids raise the jaw; the digastric, the mylohyoid and the geniohyoid depress it; and the external pterygoids, when acting singly, control the lateral movements. The grinding movements employed in the mastication of foods between the molars are produced by a combination of the various muscles. At the same time the movements of the tongue pass and hold the food between the teeth while the inner wall of the cheeks and lips prevent it from going too far outside of the teeth line. Finally, the tongue is the all-important organ in gathering the food into shape and position for the act of swallowing.

During the act of macerating and comminuting the food, it comes in contact with the first digestive secretion—the mixed saliva, from the salivary glands, which have a direct connection with the taste fibers, and the numerous mucous glands about the mouth. This secretion, in addition to its digestive action on the starches, serves also in the important functions of moistening the foods and adding mucin so as to render it suitable for swallowing. By dissolving dry and solid foods it provides a most important duty in stimulating the taste sensations, which, as Pawlow has shown even in the dog that bolts his food, is an essential step to the secretion of the gastric juice.

While the exact method of action by which the secretion is brought about is still on debatable ground among physiologists, there is little doubt that it is reflexly and quickly stimulated by the taste and even by the mere sight or thought of food in the hungry. That the presiding center for this in the human being, which no doubt is located in the medulla, can also be unfavorably affected by inverse influences, such as fear, embarrassment and anxiety, was plainly shown in one of my patients, who, as a result of a severe mental shock, suffered from a continually dry mouth and throat, had practically no salivary secretion during the mastication of her meals, and was compelled to take fluids for three days, after which time when the mental strain was abated the secretion quickly re-established itself.

Pure saliva is a colorless opalescent fluid of a weakly alkaline reaction (indicator methyl-orange), with a specific gravity of about 1.003. It has been computed that about 1500 grammes are secreted per diem. The most important constituents are a diastatic enzyme known as ptyalin, mucin, maltose, traces of protein, sulphocyanide of potassium, carbon dioxide, and a variety of inorganic salts of which the carbonates are particularly abundant (morphological elements of saliva described below).

The important constituent of the saliva is the enzyme ptyalin, or salivary diastase. Its action is energetic upon the starches which it converts into sugar and dextrin by a hydrolytic process in which the starch takes up water and undergoes a cleavage into simpler molecules. Thus is evident the practical value of cooking vegetable foods in the way of preparatory hydrolysis. The power of the ptyalin can easily be demonstrated on one's self by holding a little boiled starch or boiled potato in the mouth for a few moments and then testing same with Fehling's solution, when it will be seen that the solution is more or less reduced by the presence of sugar.

It is true that the amount of starch conversion in the mouth from the saliva is small, and also that its diastaltic action is quickly stopped by the free acid of the stomach (Chittenden has shown that 0.003 per cent. of hydrochloric acid is sufficient to arrest the action of the enzymes and there normally is more than that proportion in the gastric juice), and that there is no absorption of any of the end-products of starch before the stomach is reached. But recently proved facts concerning digestion in the stomach have shown this preparatory action to be important. Cannon and Grützner have shown that foods remain undisturbed in the fundic end of the stomach for a long time, and thus escape mixture with the acid of the gastric juice; consequently this fact is of importance in completing salivary digestion of the starchy foods, and their inversion, more or less complete, before the small intestine is reached, where this conversion is carried to its completed extent and the resulting product (maltose) is absorbed.

Here then is a matter which, in the consideration of the therapy of gastric disorders, up to this time has not received the extent of practical application it deserved. In many of the cases of abnormal gastric fermentation, and so called "amylaceous dyspepsia," conditions usually due to faulty conversion of the carbohydrates, the knowledge of these facts and their correction (which is easily brought about by the more thorough chewing of foods and the limiting of fluids taken with meals) can be of signal service in the treatment of these conditions. The author believes that the sometimes good results that have been obtained from the prevalent habit of chewing gum after meals is due to the extra saliva that is secreted and swallowed to mix with the food that is contained in the fundus in the early period after the completion of the meal, and not to any pepsin or other substances that certain makes of chewing gum may contain. In the rush and hurry of busy life, to which there came as time savers places where foods are almost on tap for immediate delivery, time

enough may not be given to the proper mastication and salivation of foods before they are swallowed. There are no teeth in the stomach, and when food has once reached there it is beyond mechanical comminution in the normal way, and, unless it has been salivated and comminuted sufficiently, digestion suffers, particularly in those who habitually partake of vegetable foods of the rough kind and meats.

If saliva be permitted to stand, two distinct layers will form, viz., an upper clear and a lower cloudy layer; the latter contains certain morphological elements. Among these are the salivary corpuscles, basement epithelial cells, and micro-organisms.

The salivary corpuscles are probably derived from leucocytes which have escaped from the glands and then undergone a change to a larger size and coarser appearance. In the many I have observed I have never been able to discern a definitely apparent nucleus in them. Up to this time no significance has been attached to these bodies.

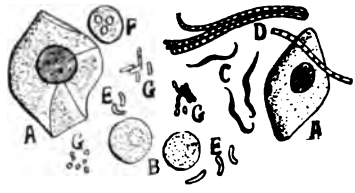


Fig. 7.—Buccal secretion from a healthy subject. *A*, Epithelial cells. *B*, Salivary corpuscles. *C*, Spirochæte buccalis. *D*, Leptothrix buccalis. *E's*, Comma bacilli of the oval cavity. *F*, Leucocyte. *G's*, Various forms of fungi. × about 1500 diameters.

The epithelial cells are large irregular polygonal ones provided with a most distinct nuclei and nucleoli. They belong to the class of stratified epithelium and often contain a large amount of fat.

Micro-organisms in large numbers are found in the mouth, and sometimes also molds and schizomycetes. Among the commonly found denizens are the Leptothrix buccalis innominata, the Bacillus buccalis maximus, the Leptothrix buccalis maxima, Iodococcus vaginatus, Spirillum sputigenum and the Spirocheta dentium. Other organisms of a non-pathogenic nature are also found—the Bacillus smegma and the Leuconostoc hominis, together with many more that little is known about because they cannot be cultivated in artificial media.

Pathological micro-organisms are also found in healthy individuals. The Diplococcus pneumoniæ is commonly present even in its virulent form. Streptococci are frequently observed; they usually are non-virulent. The pyogenic staphylococci are less common than the

streptococci. Parks and Beebe found the diphtheria bacillus in healthy throats of 8 out of 330 persons who had not been exposed to cases of diphtheria. The Micrococcus tetragenus, Bacillus pneumoniæ of Friedländer, Bacillus crassus sputigenes and the Bacillus coli communis have also been observed in normal mouths.

Deglutition is a complicated reflex act which is independent of the will although it may be initiated voluntarily. Its first part is brought about by the elevation of the body and tip of the tongue against the soft palate when the bolus of food is being pressed backward through the fauces. The second part comprises the transit through the pharynx into the esophagus. This rather complicated movement is quickly performed by the contraction of the mylohyoid muscle in the floor of the mouth (Kronecker and Meltzer[2]), assisted by the contraction of the hyoglossi, and probably by the constrictors of the pharynx. At the same time a number of other muscles are brought into action to shut off the nasal and laryngeal openings, and thus prevent the entrance of food into the corresponding cavities. The whole reflex is a finely co-ordinated movement. According to most observers, it is not necessary for the protection of the larynx that the epiglottis be pressed down, for in swallowing, the forcible uplift and anterior movement of the larynx and the descent of the base of the tongue over same sufficiently prevent the entrance of foods. The approximation of the true and false vocal cords assists in the preventing of foods from entering the larynx. The last part of the act of deglutition is the passage through the esophagus, which is involuntary. It begins after elevation of the larynx which serves also to open and enlarge the entrance of the esophagus, and since the laryngo-pharyngeal junction is normally closed this is an important point in the passage and guidance of the tip of the stomach-tube. When the food is soft or fluid it is shot through the esophagus without the necessity of peristalsis to assist it downward. Such substances arrive at the cardia in about one-tenth of a second, and may be held there (in the esophagus) for some moments until the sphincter or tone of the cardia relaxes. When, however, the food is solid or of stiff consistency, as Cannon and Moser have shown, it is forced through the esophagus by the peristaltic movements of the musculature. The circular muscles are constricted from above downward in an advancing muscular wave, while the longitudinal muscle fibers contract in advance of this wave so as to dilate the tube and facilitate the passage of the bolus. In two X-ray observations that the author made with small bags containing bismuth subnitrate, it was observed that this passage downward was continuous and took about six seconds for the

bags to reach the stomach. It will, therefore be seen that the difference in time in the passage of fluids and solid foods, such as meat, etc., is as one is to six. The advancing wave of peristalsis either forces the food through the feeble resistance offered at the cardia, or the sphincter suffers an inhibition at this moment as part of a reflex from the presence of food at that point. Kronecker and Meltzer have noted that if a second swallow was made before the bolus previously taken had reached the cardia, the passage of the lower bolus was immediately arrested at whatever portion of its path it may have reached, that it waited there until it was joined by the second, when both went down together.

Accompanying the passage of fluids through the pharynx a sound is produced which in many persons is audible at some distance. Its volume seems to depend upon the quantity and the rapidity of the passage of the fluids. More frequently, and of considerable diagnostic importance, is a sound that is produced by the passage of liquids through the cardia. Both sounds can often be heard (sometimes not the first) by placing the ear or the bell of a stethoscope at the ensiform. Often only one sound, the first or the second, is heard. This is generally due in the case of swallowing fluids to the two sounds being produced so close together (one-tenth of a second apart), and the fact that one or the other may be quite inaudible at this point. I have occasionally heard the cardia sound best in the back a little to the left of the spine in the lower dorsal region, and have heard it there when it was not audible in front. It has been my observation that it is loudest when there is more or less gas in the stomach, and also when the fluid is swallowed quickly and forcibly. In some measure the presence of these sounds is of value in diagnosing the permeability of the cardia; and in their absence, that fluids, for some obstructing reasons at the cardia or in the gullet, did not pass through the cardiac orifice or are delayed. Occasionally, with the employment of more solid foods, the cardia sound is of value in discerning deficiency in the peristaltic power of the esophagus.

GASTRIC JUICE, PHENOMENA OF SECRETION, GASTRIC MOTILITY.

THE GASTRIC JUICE.

The gastric juice in its pure state is a clear, faintly yellow fluid, acid in reaction and possessing a specific gravity of about 1.002. It has a stale, sour taste, and is almost odorless. As it is not secreted in its normal state excepting during the process of digestion

in the stomach—when it quickly becomes mixed with the foods—pure specimens of gastric juice for analysis cannot be obtained. The nearest approach to this was obtained by Pawlow in his classical experiments upon dogs with esophageal fistulæ and to which a fictitious meal had been given which did not reach the stomach, but which nevertheless reflexly stimulated the flow of the gastric juice.

It has been computed that the daily secretion of gastric juice is about one-tenth of the weight of the body. The largest constituent is water, and it is remarkable to note the small quantities of solid matter present. In this connection Schmidt's analysis of the composition of the gastric juice is: water 994.40, and solid residue 5.60 per 1000, of which the chlorides and phosphates make almost the entire quantity of salts. The reaction of the gastric juice is due to the presence of free hydrochloric acid in quantities of about 0.2 per cent. in the normal stomach, and the digestive power of the juice is due to the uniting of this free hydrochloric with the pro-enzymes, pepsinogen and rennin-zymogen, chemically forming the completed enzymes, pepsin and rennin-ferment. This is probably also true, but difficult to prove, of the third or fat-splitting enzyme, called lipase.

PHENOMENA OF SECRETION.

Pawlow's[3] work on the phenomena of secretion has cleared up much of the doubt and errors of the older observers, and has established in a clear and concise way, for all time to come, the practical facts of gastric secretion. To him, more than to anyone else, is due the credit of the fuller understanding of this important physiological function, and it may further be said, that, because of his observations, many of the older established ideas connected with the treatment of gastric disorders of the functional types are doomed to oblivion.

In very striking experiments he proved that stimulation of the peripheral end of the severed vagus, in which the secretory fibers to the gastric glandularis are contained, caused a secretion of gastric juice even after a latent period of several moments. He divided the esophagus of a dog in the neck, and secured the two ends so as to make separate openings, one above to the mouth and the other below to the stomach. When these dogs were given foods to eat they had the enjoyment of eating without having the foods reach the stomach; the foods dropping out through the upper fistula into a pan. It was found that as long as the vagus was intact this fictitious meal ("Scheinfütterung") caused an abundant flow of gastric juice, but that when the vagi were cut this was not the case. Plainly then,

the sensations of taste, smell, sight of food, and probably also the subjective satiety of the thought of food within the mouth, reflexly sets up a stimulation of the secretory nerves in the vagus. He designated this secretion as the "psychical secretion," and proved that it was due to conscious sensations. It is important to note that these sensations alone, when once started, may continue for a long time after the eating of the fictitious meal has ceased. Hornborg[4] has proved the analogue of this in man by citing the case of a boy with a stricture of the esophagus and a fistula in the stomach in whom the existence of the same psychical secretion in the human body was proven.

During the course of a meal and, under normal conditions, as long as food remains in the stomach, the gastric juice is secreted proportionate to the quantity and quality of the food. This further secretion (after the psychic juice) is due to certain substances contained in the foods designated as secretogogues (which are capable of stimulating further secretion), and not to the mechanical stimulation of foods as the older observers believed. Meat extracts, meat juices, soups, etc., are especially stimulating to the secretion, while milk and water are less so. Such common articles of food as bread, white of eggs, have but little or no effect beyond the physical secretion. The manner in which the secretogogues stimulate this cannot be positively stated. Edkins[5] claims that the secretogogues, whether preformed in the food or formed from them in the process of digestion, act upon the pyloric mucous membrane and form a substance (gastrin or gastric secretin) which is absorbed into the blood, and carried to the gastric tubules, stimulates their activity. Gastrin, as Starling has pointed out, is another example of a similar substance connected with the secretion of the pancreatic gland, and other internal secretions as well, and proposes the general term of "hormones" to designate all of them.

The researches of Pawlow and his co-workers have shown that the total quantity and properties of gastric secretion varies with different kinds of ingested foods. The quantity of secretion varies also with the amount of food in the stomach. It is also interesting to observe that this entire secretion is economically adjusted and, in the normal stomach, is quite constant. This latter fact is important in the examination of successive test-meals from the same individual taken for the purpose of noting the diagnosis, progress of gastric disease or the results from treatments. Pawlow found that the secretion produced by bread, though less in quantity than that caused by meat, nevertheless possessed greater digestive action.

The total percentage of acidity is somewhat modified by the quantity of mucus that its presence excites, but the ingestion of single foods (milk, bread, meat, etc.) proceeds with an extraordinary exactness both in quantity of juice and the amounts of contained ferments. The total quantity of acidity is highest on a meat and lowest on a bread diet. With reference to the amount of weight, the greatest quantity of gastric juice is required by meat and the smallest quantity by milk. In all diets, a pause of from four and a half to ten minutes exists between the introduction of the foods and the beginning of direct secretion; this is called the "latent period." Hence it is, that gastric secretion begins by a reflex to the stomach from the stimulation of the special senses—taste, smell, and sight of food. This is followed by a short interval or pause, after which the stimulation of the secretory and trophic fibers of the gastric glands, "appetite juice," continues the secretion until the departure of the contents from the stomach, and also beyond for a short time during digestion in the small intestine. In the latter portion of the digestive tract the innervation of the pancreas and its secretion is reflexedly stimulated by the acidity of the chyme from the stomach, and the degree of this stimulation is proportionate to the degree of acidity of the chyme, a neutralization of the latter causing inhibition of pancreatic secretion.

GASTRIC MOTILITY.

The motor activity of the stomach serves to mix the foods, to encourage their saturation with the gastric juice, and to press the chyme onward into the small intestine. The first is accomplished by the motor activity of the stomach assisted by the passive movements transmitted to the stomach by the diaphragm and abdominal muscles during respiration, by the compression of the liver and spleen, and the impulse transmitted to the stomach by the heart.

After a meal, the solid food remains in the stomach for some hours. During this time, the stomach contracts upon it in such a way that the thinner portions of chyme are ejected intermittently from time to time through the pylorus into the intestine. Except at certain times when the pylorus opens, the food is shut up within the organ by the spastic contraction of the pylorus and the tonic contraction of the cardia.

The first movements of the stomach during digestion are the rhythmic contractions of a peristaltic nature that begin slightly in the fundus and pass with increasing force to the pyloric region; in this the circular fibers are the most active. In the pyloric region, and less so

in the body of the organ, as digestion continues these waves may be noted by X-rays to occur regularly and to be most active. They also serve to lengthen the pyloric region into which the food is pressed from the intermediate portion. The obvious result of these movements is to mix the food thoroughly in the smaller part of the stomach where the most active part of gastric digestion takes place. This mixing with the acid gastric juice reduces the food to a thin liquid mass—the chyme. The pylorus then opens, probably assisted by the shortening of the whole pyloric region, and this fluid mass is delivered into the duodenum. According to Cannon, this irregular act of the pylorus occurs in the human being about every twenty seconds and is dependent upon the acidity of the chyme and the consistency of the food directly inside of the pyloric valve at that time.

In several X-ray observations and stomach-tube examinations that I made in cases of atrophic gastritis where there was present a complete anacidity in so far as hydrochloric acid was concerned and only a very low proteolytic digestive capacity, showed that the absence of the hydrochloric acid in the chyme made but little practical difference in the regular action of the pyloric muscle. It was noted that this reflex was performed in almost the regular way, occasionally somewhat delayed, and that the stomach was emptied in about the proper length of time. For these observations the patients had been made to eat boiled vegetables and meat foods of as firm consistency as possible. Certainly in these cases no mineral acids of determinable quantities were present with the food in the stomach, and in several of them tests of extracted small quantities of the meals showed no increase of acidity (organic acids) above that of the foods before they had been ingested. It is my belief, based on these observations that the consistency of the chyme at the pylorus, and probably its newly formed chemical constituents, has more to do with the relaxation of the pylorus than does the degree of acidity itself. This belief is fortified in being so by the fact that fluid food, when taken alone, may be forced into the duodenum within a few minutes after ingestion. Furthermore, I observed that during these digestions the movements were not increased over that of the normal stomach (hypermotility), and that no abnormal change in the pyloric muscle (pyloric relaxation) existed. Also, that although there was practically no acid present in the chyme as it was passing into the duodenum, in these cases, the pylorus closed properly thereby preventing for the time being further exit of food. This may have been due to the reflex alone, to the presence of secretogogues, or possibly to the mere presence of food in the first part of the duodenum.

According to Cannon, hydrochloric acid in the stomach seems to favor or produce a relaxation of the pyloric sphincter, and when this acid gastric chyme is in the duodenum it causes a contraction of the sphincter. In this way, it is assumed that the pylorus is opened for the exit of the food, and closed again when it is in the small intestine where its acidity becomes neutralized by the alkaline secretion of this part of the alimentary canal, and after which, the pylorus again opens for the exit of more food to the small intestine, and so on, until the stomach is emptied.

The older views on gastric motility were, that the contents of the stomach went through the course of rotary movement in the direction of down the greater curvature and back again along the lesser until the contents were uniformly mixed. Grützner[6] (also Cannon) have shown contrary to this, that the slight waves in the fundic end do not materially affect the contents in that part for a long time, and that the food there, to a great extent, escapes admixture with the acid gastric juice. This is a most important fact in connection with the salivary digestion of starchy foods. Under these conditions the salivary digestion (ptyalin) may go on for an hour or more before it is inhibited by coming in contact with the acid of the gastric juice. Grützner has shown in rats (and most probably the same fact also exists in man) that swallowed foods arrange themselves in consecutive layers in the stomach, one layer inside of the previous one. In all probability, because the stomach when empty has a certain definite size even when its walls may be in more or less contact in the pyloric region and body (the fundic end is never in contact as it usually contains some gas), the first morsels of a meal take a general course anywhere in the organ until a certain quantity of food is contained in the viscus. Then, as more food is added, the stomach is distended and exerts an equal and tonic pressure within, and the food after that arranges itself in layers in the interior of the cavity. It is obvious that the taking of fluids with the meals might, by acting as a diluent to the gastric juice, cause the hydrochloric acid to more quickly permeate the more quiet fundic portion and thus stop or interfere with the conversion of the starches by the ptyalin. While definite baneful effects of this midmeal-drinking is difficult to prove, there is much suggestion contained in the gastric distress of many of those who partake largely and habitually of soups before the solid portions of the meal, or the dyspeptic American who washes down his food with ice-water. In these, most of whom are cases of sensory neuroses, the simple taking of a drier diet free from fluids is all that is necessary to correct the condition. And along these same lines comes

much of the benefit of eliminating the fluids in cases of simple gastric atony and atonic ectasia not due to pyloric stenosis. In these latter conditions, the muscular tone of the stomach is impaired, and the ingested fluids mix more readily with the solid portions of the food even in the fundic end. From recent physiological observations it would seem as though nature provided against the danger of the diluting of the gastric contents during digestion by the drinking of fluids during the course of a meal, by the rapid elimination of this fluid from the stomach into the intestine. O. Cohnheim has laid much stress on the observation that even in a stomach containing much food, the ingestion of a large quantity of fluid causes a separation of the food from the lesser curvature, along which the fluid runs quickly into the duodenum. It would thus seem probable that under such conditions more or less inhibition of gastric digestion takes place at those moments, and that the acid-enzymotic secretion in the locality through which the fluid is washing is more or less carried out of the organ with it.

It has been found that the carbohydrate foods begin to pass out of the stomach soon after ingestion, and require but about one-half of the time necessary for the proteins (meat, fish, etc.). Fats remain long in the stomach when taken alone, and when combined with other foodstuffs they markedly delay their exit through the pylorus. Cannon has shown that this regulation is controlled by the stomach itself and is independent of the extrinsic nerves. If in a given diet of carbohydrate and protein the carbohydrate is taken first, it, having the pyloric position in the stomach, will quickly pass out through the pylorus while the protein remains for more thorough gastric digestion. But if this is reversed and the protein is fed first, the passage of the carbohydrate will be materially delayed.

Regarding the general mechanism of the stomach it may be stated that it forms an admirably adapted organ for receiving in a short space of time a large amount of food, which it reduces to a fluid or semifluid state. This reduction is brought about in a chemical and mechanical way, and when completed, small quantities are sent into the intestine under such conditions as insure the most rapid digestion and absorption.

The stomach, like the intestines, is essentially an automatic organ. The vagi and splanchnics merely regulate the peristaltic and shortening actions. It has been proved that gastric secretion and motility proceed after the extrinsic nerves have been severed, and thus the stimuli to these functions must arise within the organ itself, controlled to adaption according to the varying conditions present.

This automaticity probably resides in the Meissner and Auerbach plexuses found in its coats. In the extrinsic nerves it has been shown that the motor-fibers are supplied by the vagus and the inhibitory fibers by the splanchnics. Through their activity the movements of the stomach may be influenced favorably or unfavorably according to conditions which directly or indirectly affect the central nervous system. This is important to remember in connection with the effects of corporal pain and the emotions (worry, anxiety, distress and rage) on secretion and motility.

HYDROCHLORIC ACID OF GASTRIC JUICE.

It is now definitely settled that the acidity of normal gastric juice is due to the presence of free hydrochloric acid. This was first demonstrated satisfactorily by Schmidt (1847) who proved that the precipitation of the contained chlorides in gastric juice by the silver nitrate method, showed that the total amount of chlorides was greater than could be held by the bases present in the secretion—thus, evidently, some of the chlorine must have been present in combination with hydrogen as hydrochloric acid. That this acidity was due to a free mineral acid and not to an organic is proved by the reactions of the color tests; methyl-violet, which turns blue; congo-red, which is changed from red to blue; and 00 tropeolin, from a yellow to a pink or red.

The percentage of hydrochloric acid in the gastric juice varies from 0.1 to 0.3 per cent. In the carnivorous animals, like the dog, it is considerably higher, 0.4 per cent. or more. The amount varies according to the period of digestion. In the beginning of the process, the secretion does not possess its full acidity owing to the fact that it is still scanty in amount, a portion of the acid being neutralized by the saliva taken with the food, and the alkaline mucus (gastric particularly), and also by the alkaline secretion of the pyloric end of the stomach (Heidenhain). During the course of digestion its acidity may reach (Hornborg) to 0.4 or 0.5 per cent. The author believes that the latter figures are nearer to the amount normally secreted than are those first given (0.1 to 0.2 per cent.). His belief is based mainly upon a series of observations made upon three athletic young men who apparently had normal digestion. They were given both the simple (Ewald) and the mixed meals (Riegel), which were extracted on different occasions at ten- to twenty-minute intervals, and examined according to the Hayem and Winter method of estimating the total chlorides. My percentages ran quite uniformly in each

individual, from 0.30 to 0.45 per cent. At the beginning and the end of gastric digestion the percentages were markedly lower.

The hydrochloric acid of gastric juice acts in a number of different ways, all of which are of great importance to the normal process of digestion. It is antizymotic and antiseptic because it prevents abnormal fermentation and destroys pathogenic organisms which enter the stomach with the foods (Koch, Falk, Macfadyen and others). That this property of the acid is of great value as a safeguard to the economy from infections is plainly obvious.

A well-nourished young woman of twenty-five years was under my observation some time ago, who, three years before, had contracted typhoid fever of a severe degree. She had, when I first saw her, a hypochlorhydria of about 0.05 per cent., which failed to make any definite or sustained advance in the face of all methods of treatment. On a diet which seemed most suitable to her low gastric acidity and which kept her free from abnormal gastric fermentation after her meals, she went to a seashore resort in New Jersey, where she again contracted typhoid. Three years after this she developed intestinal tuberculosis presenting upon examination palpable mesentery nodules (no doubt tubercular), and she finally succumbed with a tubercular peritonitis. I feel that the persistently low acidity of her stomach had to do with the susceptibility of her intestinal canal to this enteric infection.

Hydrochloric acid has the property of activating the pro-enzymes of the stomach (pepsinogen, rennin-zymogen) into the active enzymes (pepsin, rennin-ferment) according to Langley in one minute and to a general extent. Because organic acids can also activate the pro-enzymes (not so quickly or thoroughly) it is probable that a chemical union of the hydrochloric acid with the pro-enzymes does not take place—just, that an acid media is essential for their conversion into the active form of ferments.

Hydrochloric acid is probably of service in regulating gastric peristalsis, and possibly in effecting the opening and closing of the pylorus for the exit of the chyme.

After activating the pro-enzyme of pepsin, hydrochloric acid assists materially in the conversion of the protein into an acid albumin, and then continues this on through the intermediate stages of proteolysis until the peptones are formed. Pepsin, however, is an essential element in this process.

Hydrochloric acid has the property of converting cane into invert sugar (dextrose and levulose) which is a more readily digestible product for the upper enteric canal.

And lastly, hydrochloric acid is an important stimulant of pancreatic secretion (Dolinsky[7] and Walter[8]). This secretion, under normal conditions, depends upon the acidity of the chyme while in its

passage through the upper part of the duodenum. The secretion is brought about reflexly by the free acid; and thus the influence of the acid in this most important part of the entire digestive tract.

The presence of hydrochloric acid in the stomach is striking because it is the only instance of a secretion of the body that contains a free or a mineral acid. It is generally believed that the border cells of the gastric tubules constitute the acid secreting cells. This belief is based upon the fact that, in those parts of the stomach in which these cells most fully abound—the body and fundic end of the stomach —the secretion is distinctly acid, and where they are absent (pyloric end) the secretion is alkaline. Important also in this connection are the post-mortem observations of Hemmeter[9] in cases of pronounced and persistent hyperchlorhydria that have died from intercurrent diseases. In serial sections of these stomachs it was found that in the intermediate zone and fundus, the acid (as well as the central) cells were increased in numbers.

With regard to the origin of the acid, as none exists in the blood, it must originate from the secreting cells in the gastric tubules and that the chlorides of the blood most probably supply the HCl content of the gastric juice. Just how this comes about is still in the field of debate in which the hypothesis of Maly seems the most acceptable. According to this author the blood is an alkaline fluid due to the presence of the two acid salts of phosphate of soda (Na_2HPO_4). The blood contains an excess of carbonic acid (CO_2), which, acting upon the disodium phosphate produces monosodium phosphate:—

$$Na_2HPO_4 + CO_2 + H_2O = NaHCO_3 + NaH_2PO_4$$

The chief chloride of the blood is sodium chloride (NaCl), and the chlorine of this is set free according to the following equation:—

$$NaH_2PO_4 + NaCl = Na_2HPO_4 + HCl$$

In support of this it has been shown that if the chlorides in the blood are reduced by removing them from the food for a sufficient length of time, the secretion of gastric juice no longer contains hydrochloric acid, although organic acids may be found present. Until it can be proven that the above hypothesis is not correct we must be content in believing that in the acid-forming cells the neutral chlorides (sodium chloride) of the blood are broken up liberating HCl upon the free surface of the stomach.

PEPSINOGEN AND PEPSIN.

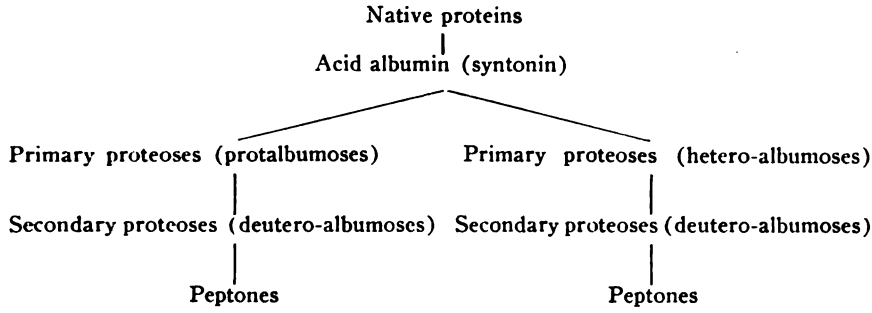
Pepsin is a typical proteolytic ferment acting only in an acid media. In the presence of the hydrochloric acid it converts albuminoid bodies into peptones and deprives gelatin of its jelly-forming property converting it into gelatin-peptone. Hydrochloric acid is the most able adjuvant to the combination of pro-enzyme and acid, as other mineral and organic acids are decidedly less active and perfect in this regard. The exact chemical nature of pepsin is still unknown, although it is believed to be a protein or protein-containing body. As it does not contain phosphorus in its chemical make up it does not belong to the group of nucleo-proteins.

Pepsinogen can be readily extracted from the glandular membrane of the stomach where it is formed by the chief or central cells. As a product, it differs from pepsin itself by its slow destruction by an alkali (sodium carbonate) and its high power of resistance. Its secretion is rarely destroyed even by marked pathological changes in the stomach (chronic catarrh, and sometimes even in carcinoma). It is secreted by the glands in all parts of the stomach, even in the alkaline pyloric region. One may believe that it is the true secretion of the central cells which the hydrochloric acid makes functionally active by supplying to it the best acid for the action of its proteolytic properties. Pepsinogen itself has little or no action upon the reduction of proteins in digestion.

Solid proteins when exposed to the action of a normal or artificial gastric juice swell up and eventually pass into solution. The soluble product thus formed is not coagulable by heat (like native proteins) and is remarkable for its diffusing properties, even beyond that of other forms of soluble proteins. To the end-products of pepsin-hydrochloric digestion of proteins and gelatin substances is given the name of peptones.

The process of reduction from native proteins to peptones is complicated, and because of the rapidity of the changing and combined compositions it is difficult to determine exactly the chemistry of the intermediate products. The first step, however, is the change of the native protein to an acid albumin called syntonin. This change is brought about by the acid, but mostly and more quickly so by the action of the pepsin-hydrochloric acid compound. As syntonin it remains in solution in both an acid or alkaline media but is precipitated in the presence of a neutral reaction so thus it has also been called the neutralization precipitate. Continuation of the activity of the gastric juice causes the syntonin to pass into a further state of

hydrolysis, and it is then no longer precipitated in the neutral media. The product at this time is a combination of bodies, which, as a group, are designated the primary proteoses (albumoses), and with which are found minute quantities of peptone (Kühne). This group of bodies, the proteoses further reduce to a group called the secondary proteoses (deutero-albumoses). As compared with the primary proteoses, the secondary ones are distinguished by a greater solubility, and they are more resistant to precipitation by the neutral salts. The secondary proteoses undergo still further hydrolysis in the production of the peptones. In order to make these relationships clearer the following schema is offered:—



The peptones are the most soluble substances of the group of compounds formed in peptic digestion. They are proteins which react to the biuret test, but are not coagulable by heat nor precipitated when its solutions are completely saturated with ammonium sulphate or any of the agents ordinarily used in tests for albumin (nitric, acetic, picric acids, potassium ferrocyanide, hydrargyro-iodide of potassium).

The various products between the native proteins and the peptones are distinguished by Neumeister by the following reactions: The primary proteoses may be precipitated from neutral solutions by means of sodium chloride; a neutral solution of secondary proteoses remains perfectly clear, a precipitation occurring, however, upon the addition of an acid. Potassium ferrocyanide, acetic acid, neutral solution of copper sulphate and an excess of picric acid precipitates the primary proteoses with but little more difficulty than the native albumins. On the other hand, the secondary proteoses react but very slowly to acetic acid and potassium ferrocyanide.

The above represents the reactions of definite products of protein conversion. But in the examinations of the end or transmission products, as they are found in test-meals, these reactions are not of

practical value. The results obtained are usually obscure and indefinite, and it is but seldom that one can estimate which of these constantly changing products are present or present in the largest quantities. The trouble lies in the combinations that are present at the same moment—from the native albumin to the peptones, all grades of the converted products are mixed together—and these represent (Howell)[10] a hydrolytic cleavage of the protein molecules of a weight from 5000 to 7000 in the native proteins, down to the much smaller and more soluble molecules whose molecular weights are perhaps only 250 to 400 or less. The nearest approach to the estimation of the proteolytic power of the gastric juice is by the way of the indirect tests (Mett, Brücke and Grützner), in which the conversion power that then exists in the obtained juice is estimated, and not the naturally formed products that are already present in the test-meal.

RENNIN-ZYMOGEN AND RENNIN-FERMENT.

Rennin-ferment, rennet, or chymosin, exists in the human stomach from early childhood. As far as our knowledge goes, the action of this enzyme is confined to milk, which it coagulates, precipitating its casein in neutral solutions. As milk and milk foods form an important article of diet in the human being, the action of this enzyme, if there be one, is important. The action of the rennin goes no further than the coagulation of the milk. After this, the digestion of the curd is carried on by the pepsin, and in the intestine by the trypsin with the ultimate formation of peptones as in the case of other proteins.

Rennin causes milk to clot with great rapidity. In the case of cows' milk the entire milk becomes fairly solid, after which, if undisturbed, the clot shrinks and presses out a clear yellowish fluid called whey. With human milk the curd is less firm and takes the form of loose flocculi. The process in cows' milk resembles the clotting of blood. The rapidity of the clotting varies inversely according to the amount of rennin present and the temperature of the milk. Its action seems to require the presence of the soluble calcium salts; in the absence of these, milk does not curdle upon the addition of rennin. The foregoing facts are important to remember, because they form the basis for qualitative and quantitative estimations of chymosin and its pro-ferment substance or for the peptogenic power of the gastric juice as is suggested below. It should be added, that casein is also precipitated from milk by the direct addition of an excess of acid, or by the effects of bacteria upon milk-sugar (lactose) when they

cause the formation of sufficient quantities of lactic acid to effect precipitation.

Like pepsin, chymosin is said to possess a previous stage known as rennin-zymogen or lab-zymogen. This, when treated with acids, is rapidly converted into the active form of the ferment. Also like pepsin, the rennin-ferment is destroyed by alkalies, even in weak solutions; whereas the rennin-zymogen, like pepsinogen, remains practically unaffected.

Because observers have not succeeded in extracting rennin, or its prodrome, from the mucosa of the pyloric region of the stomach, it is supposed to be secreted only in the fundic end and intermediate regions of the organ. The source of this secretion is, in all probability, the same as that of the pepsinogen, namely, the central cells of the gastric tubules. Boas[11] claims that rennin-enzyme is not at all affected by pepsin, saliva, or fat, and only by bile in so far that it deprives the gastric juice of a portion of its acid and thus interferes in the conversion of pro-enzymes into active enzymes.

With Cohnheim, it is my belief that there is no distinct milk curdling ferment in the human stomach, and that this clotting is accomplished by the pepsin alone as a preparatory step in the digestion of casein. In proof of this is the fact that milk curdling always takes place by the addition of pepsin to fresh milk (rapidly when an acid is also present, and more slowly but still definitely, when it is very slight), and also the fact that the isolation of this enzyme up to the present has been impossible.

LIPASE.

Lipase, or the fat-splitting ferment, is a product of the normal stomach in man (Volhard[12]). It strongly resembles the steapsin of the pancreatic juice and acts most readily upon emulsified fats as they appear in some of the natural foods, such as milk, cream and yolk of egg. The ferment, like pepsin, is secreted mostly from the fundus, but not at all from the pyloric end. As its action is destroyed by weak alkalies, and that a prior formed substance to the actual ferment is but difficultly destroyed by it and then only by a considerable amount of caustic alkali, it is probable that a zymogen also exists for this ferment. The hydrochloric acid does not seem to be necessary for the conversion of fats, for this ferment works as well in neutralized gastric juice; but alcohol destroys its functions. The content of its hydrolytic power on emulsified fatty natural foods has been computed to run as high as 70 per cent.

Much of the digested fat of foods undergoes practically no change in the stomach. Regarding the fat of meat for instance, this is set free from their cells by the dissolving action of the gastric juice upon the proteins, the fat existing in mixture with the other foodstuffs. The fat is then liquefied by the heat of the body and disseminated through the chyme in a coarse emulsion by the movements of the stomach. In this way it is mechanically prepared for saponification and emulsification by the pancreatic juice in the small intestine.

MUCUS.

The mucus that is found in the stomach contents is a composite mixture of that formed by the epithelium of the stomach (gastric mucus), and the secretion from above in the mixed saliva, mouth, throat and esophageal glands. While mucus and saliva which had been swallowed during a meal can usually be found in extracted test-meals as foamy masses floating on the top, nevertheless much of the swallowed mucus becomes thinned and intimately mixed with the gastric variety.

As a result of several observations that I made on a patient who had been fed on identical meals of a semisolid nature (at one time in the normal way of mastication, insalivation and deglutition, and at others through a stomach tube into an empty stomach so that the meal did not come in contact with the mouth, throat and esophagus) I observed that after carefully skimming the clumps from the swallowed meals, the amounts of mucus intimately and inseparably contained in those meals was perceptibly increased in quantity above that contained in the meals that had been delivered into the stomach by way of the stomach tube.

The presence of mucus is evident to the naked eye by its stringy and tenacious character. That of the gastric epithelium is usually mixed with the food (incorporated mucus) and if separated from the meal sinks in standing water, while that from the pharynx is separate and floats on top. The normal stomach secretes but a small amount of mucus, and when the incorporated form of this is increased by gastric digestion it is pathological and indicative of gastritis. The highest degree of admixture is seen when the hydrochloric secretion of a stomach is absent or low (long standing gastritis, carcinoma). On the other hand, little or no increase is observed in acute ulcer, the neuroses, atonies, or benign stenoses of the pylorus. In the acid form of gastritis (gastritis acida) where the secretion of hydrochloric acid is high, the amount of gastric mucus is usually quite large.

Mucus is dissolved or digested by gastric juice, but it requires

twice as long as albumin for its solution (Schmidt[13]). According to the amount of HCl present and the period of digestion, gastric mucus is found in glassy transparent masses or as shreds or fibers. Very small, still fairly well defined corpuscles are found in the fibrillary base structure (mucous corpuscles), together with many free nuclei, which probably are the digested remains of the corpuscles and epithelial cells. Pavement epithelium suggests its origin from above

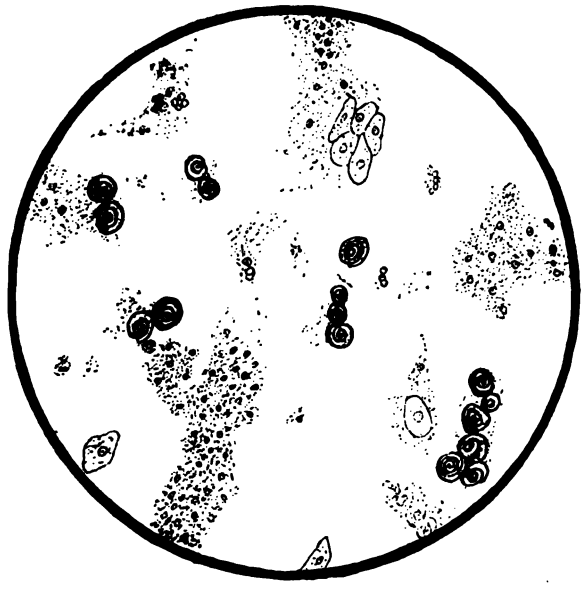


Fig. 8.—A specimen of gastric content aspirated from a patient in a fasting condition, showing the snail-like cells from mucus, singly and in groups, mucus and mucous corpuscles, some squamous epithelial cells, and amorphous material.

the stomach, and ciliated columnar cells from the respiratory tract, upper pharynx or posterior nares.

The occurrence of snail-like cells were first described by Jaworski.[14] They are of no pathological significance and I agree with Boas[15] that they are commonly found. They are resulting formations of mucus which had been acted upon by HCl or fungi.

NORMAL FERMENTATION.

Swallowed with the foods into the stomach are various micro-organisms, which, under the favorable influence of the low acidity of beginning digestion, rapidly multiply and cause fermentation of the

carbohydrates with the production of gases. This fermentation continues, with a slight addition from the proteids, until the height of acidity is reached when it is inhibited. The normal stomach in the height of digestion of a meal contains none or only a trivial amount of gas, and when this is present, it is always at the fundus until the organ has quite emptied into the duodenum, when the gas may also pass through the pylorus in small quantities, although it is usually retained in the stomach undergoing more or less absorption or ejection by eructation, all but a small quantity which is generally present.

The commonest organism in the production of fermentation is the lactic acid bacillus. It splits the sugar of milk into lactic acid, also carbonic, acetic, formin, succinic and perhaps butyric acids. More or less hydrogen is also formed. The bacillus also possesses the properties of inversion, and the power of splitting cane sugar and mannite into lactic and carbonic acids. A number of other microorganisms also exist which are capable of forming lactic acid in the stomach.

Butyric acid fermentation is due to various forms of bacteria. These are of the anaërobic variety, the example of which is the rod-shaped bacillus butyricus the spores of which are found in a variety of shapes (Prazmowski[16]). As butyric acid fermentation occurs in milk after lactic acid has first been formed, it is possible that it might be one of the steps downward from the reduction of lactose to carbonic acid and hydrogen.

Acetic acid fermentation may occur by the action of the fungus of acetic acid (mycoderma aceti) upon alcohol, by the production of aldehyde which undergoes oxidation and forms acetic acid. This type of fermentation is usually found in those who partake of alcoholic beverages at meal times. It can also take place indirectly from yeast fermentation of carbohydrates.

Yeast fermentation depends upon the presence of the various forms of saccharomyces which have the property of splitting up glucose and forming alcohol and carbonic acid. As the yeast fungi are found in all breads, rolls and so on, and these foods are so generally partaken of at meals, and that hydrochloric acid in the quantities usually found in the stomach has no effect upon this process of fermentation found in normal stomachs, the author believes the lactic acid fermentation to be the commonest type of fermentation found in normal stomachs, and the acetic and butyric acid (and no doubt other types) come last.

The type of fermentation that is most prevalent in normal individuals is due to the character of his foods and drink, and somewhat

to his eating habits. It is evident that combinations of the above mentioned fermentations could exist at the same time in a stomach.

ABSORPTION.

In the stomach the following food substances are possible of absorption: Water, salts, sugars and dextrins, that may be formed from the salivary digestion of starch or swallowed as such, and the proteoses and peptones formed in the peptic digestion of proteins or albuminoids. In addition there is absorption of soluble liquid substances, such as alcohol, drugs, etc. On the whole it may be stated that absorption from the stomach is nothing like so perfect or quick as that from the intestines.

Water taken alone is practically not absorbed in the stomach, but is in the intestines. Von Mering has shown that as soon as water is introduced into the empty stomach it begins to pass into the intestines by a series of spurts, caused by the contractions of the stomach, and in a short time the stomach is empty. With other fluids, however, this does not take place, but the more concentrated they are the greater is the degree of absorption.

The absorption of salts from the stomach depends upon their degree of concentration. According to Brandl, sodium iodide is absorbed very slowly or not at all in dilute solution. In solutions of 3 per cent. or over the absorption becomes important. This is probably true of the other salines, and, as saline solutions of 3 per cent. or over are seldom taken by the human being, it may be stated that the degree of saline absorption in the stomach is small or not at all, unless condiments, alcohol, etc., are present at the same time, when it is much facilitated (in this case the absorption is due to gastric congestion or stimulation of the epithelium).

Sugars, peptones, mucus, gelatin and vegetable gums are absorbed from the stomach, but not completely and only poorly so. Brandl's investigations proved that only about 5 per cent. of the peptones were taken up by this organ and this at the end of two hours. Dextrose, lactose, saccharose (cane sugar), maltose and dextrin are absorbed, but also far short of completely. Brandl reports that sugars and peptones are not absorbed until in strengths of solutions of 5 per cent. or over; on the whole then, it may be said that these food products are absorbed with some difficulty.

Fats are not absorbed from the stomach, neither in the saponified or emulsified form, including that acted upon by the lipase, or when in the more fluid state. Alcohol is absorbed most readily (even 20

per cent. solutions), and most of the medicaments (strychnine, etc.) but very poorly (Meltzer).

References.

[1] Cushing: Bulletin of the Johns Hopkins Hospital, 14, 71, 1903.
[2] Kronecker and Meltzer: "Archiv f. Physiologie," 1883, supple. vol., 328.
[3] Pawlow: "The Work of the Digestive Glands," translated by Thompson, 1902.
[4] Hornborg: "Skandinavisches Archiv f. Physiologie," 15, 209, 1904.
[5] Edkins: Journal of Physiology, 1906, xxxiv, p. 133.
[6] Grutzner: "Archiv f. diegesammte Physiologie," p. 106, 463.
[7] Dolinsky: Ref. nach Malay's Jahresbericht, Bd. 24, resp. 29.
[8] Walter: Ref. nach Malay's Jahresbericht, Bd. 24, resp. 29.
[9] Hemmeter: "Diseases of the Stomach," third edition, p. 814.
[10] Howell: "Text-book of Physiology," second edition, p. 715.
[11] Boas: "Diseases of the Stomach," p. 34.
[12] Vollard: Münchener medizin. Wochenschrift, 1900, 5-6.
[13] Schmidt: Deutsch. Archiv f. klinische Medizin., Bd. lvii, S. 72.
[14] Jaworski: Münchener medizin. Wochenschrift, 1887, Nu. 32.
[15] Boas: "Diseases of the Stomach," p. 231.
[16] Prazmowski: Untersuchungen über die Entwicklung, und Fermentwirkung einiger Bakterionarten., Leipzig, 1880.

CHAPTER III.

Physiology and Chemistry.

(*Continued.*)

SINCE Pasteur's brilliant work on fermentations, ferments have been divided into two great groups; the living or organized ferments, such as yeast, bacteria, etc., and the non-living or unorganized ferments, such as pepsin, trypsin, etc. To the latter Kuhne has given the name of enzymes. Buchner (1897) showed that unorganized ferments existed in yeast cells and in lactic acid producing bacteria, and so it is most probable that in the case of organized ferments the action of these living bodies was due to a specific soluble product of them of a non-living nature rather than to a direct change produced by the life metabolism of the cells themselves.

At the present day, the most tenable theory of the nature of enzymotic processes is that they produce in some mysterious way changes similar to catalysis. A catalyzer is a substance that alters the velocity of a reaction, but does not initiate it (Howell[1]). It is, therefore, assumed that the enzymes of the body act as catalyzers of inorganic origin.

SPECIFICITY OF ENZYMES.

The main feature of the action of enzymes is that they are specific. Those that affect the proteins are not capable of action upon the carbohydrates and *vice versâ*. The fat-splitting enzymes are likewise specific. It is believed to-day, that each substance has its own specific enzyme to convert it, and that the normal body secretes these as is demanded. The pancreatic juice, for example, splits proteins, starches, fats and curdles milk, and there are assumed to be separate enzymes present to do this, namely, trypsin, diastase, lipase, and rennin, although here, as with the pepsin, a specific enzyme for curdling milk is not present. The fact that even the closely related substances like double sugar require more than one enzyme to reduce it—one for maltose and another lactose,—that all enzymes may be capable of reversible reactions (lipase), that so little is known of them as definite substances, and that different ones are multiplying in such large

numbers, rather suggests the presence in the body of a father body of them all. Fisher has advanced the theory that the specificity of the different enzymes is related according to the geometrical structure of the substance acted upon.

The enzymes themselves are organic substances of a colloid nature. They are formed from the living tissue, and solutions of them usually give protein reactions. Their structure is separate and distinct from the proteins, as they have been separated from their close protein association and still they show their specific activities.

ENZYMES CONCERNED IN THE PROCESS OF DIGESTION.

	Enzyme.	*Where found.*	*Action.*
Act on carbohydrates.	Ptyalin.	Saliva.	Converts starch to maltose sugar.
	Amylopsin.	Pancreatic juice.	Converts starch to maltose sugar.
	Invertase.	Small intestine.	Converts cane sugar to dextrose and levulose.
	Maltase.	Small intestine. Saliva. Pancreatic juice.	Converts maltose to dextrose.
	Lactose.	Small intestine.	Converts maltose to dextrose and galactose.
Act on fats.	Lipase.	Gastric juice.	Splits neutral fats to fatty acids and glycerin.
	Steapsin.	Pancreatic juice.	Splits natural fats to fatty acids and glycerin.
Act on proteids.	Pepsin.	Gastric juice.	Converts proteins to peptones and proteoses.
	Trypsin.	Pancreatic juice.	Splits proteins to the crystalline product for absorption.
	Erepsin.	Small intestine.	Splits peptones for absorption.

REVERSIBLE REACTIONS.

Accepting the enzymes as catalyzers, it is probable that, like with certain chemical substances, they are capable of opposite changes toward an equilibrium—that is, that they may proceed in two directions until a new equilibrium is established. An interesting example of this is the double effect of lipase (Kastle and Loewenhart[2]). These authors showed that lipase causes not only an hydrolysis of ethyl-butyrate into ethyl-alcohol and butyric acid, but that a synthesis of the last named substances could take place into ethyl-butyrate and water. The presence of this reaction in the tissues of the body offers

the best solution for the storing of fats in the subcutaneous tissue on the one hand, and their absorption from these tissues during starvation on the other. A similar reversibility has been shown for some of the other enzymes of the body. Whether they all possess this faculty and that it is actively going on more or less in the body has not been determined.

GENERAL SUMMARY OF THE ENTIRE PROCESS OF DIGESTION.

To meet the consumption of the structures of the body, to build up tissue in the young and maintain the equilibrium of weight, strength and reserve force in the adult, foods, in solid or fluid forms are essential. The desire for them arises in the general body but manifests itself most subjectively in the organs concerned in the processes of digestion—the alimentary tract, and the stomach most of all. This sense in its ordinary manifestation may be designated as appetite, and in pronounced conditions as hunger. In the usual manifestation (appetite), individual habits in the way of quantities and character of foods, routine, and so on, make differences between us. Hunger, however, is a passionate longing, real and insistent, and quite the same in all. Added to the organic foods, water and inorganic salts are necessary to meet the sensation of thirst, and act as the medium favorable for their digestion, absorption, assimilation, oxidation, and excretion. Thirst is also of corporeal origin, manifested mainly upon the membrane of the pharynx.

Taking a normal person in whom the desire for food exists, the process of digestion may be described briefly as follows. The thought of being about to partake of food, the smell and sight of its cooking and its presence before them initiate the process of digestion (psychical secretion). Added to this now comes the effects on salivary and gastric secretions brought reflexly about by the stimulation of foods on the sensations of taste and smell. As the molars grind and comminute food in mastication, the ptyalin begins its work upon the hydrated starches or raw starch flour which had been freed from the encasement of its granules and thus is capable of absorbing water. The fluid saliva renders the food more pultaceous, and the mucus supplied to it from the mouth glands and lower salivaries lubricates it. After this, the dorsum of the tongue presses it backward into the depth of the pharynx from which it descends into the esophagus, where, by peristaltic movement, it is delivered through the cardia into the stomach.

Already, the stomach is at work secreting gastric juice to meet this bolus, which, beginning gastric motility distributes along the organ toward the pylorus. As the meal continues, the vascular supply to the mucosa increases causing it to take on a pinkish hue, and the flow of gastric juice increases in quantity from the direct stimulation of the food on the secreting apparatus and the action of the secretogogues. The juice, with its hydrochloric acid and enzymes, discharges from the tubules on the free surface of the stomach, and the inclined shape of the walls of the stomach with the assistance of gastric peristalsis encourages the juice to run towards the pyloric end and mix generally with the food, causing quick proteolysis, the splitting of the emulsified neutral fats, inhibiting the action of the ptyalin, and adding sufficient acidity to permit of the opening and closing of the pyloric sphincter so that the prepared chyme can be sent at regular intervals into the small intestine.

As the organ continues to fill with food, the meal stratifies itself in the axis of the viscus away from the acidified chyme at the surface. In the pyloric and intermediate portions, active peristalsis and shortening of the organ work the chyme onward, while the fundic end and cardia hold the food in a tonic grasp to further permit the ptyalin of the saliva to continue the reduction of the starches present. Depending upon the character and amount of food ingested, the acid enzymotic content of the gastric juice raises (adaptation juice) until it is of sufficient concentration.

About at the middle period of gastric digestion, the entire mass is markedly acidified and the conversion of starches has ceased. The organ is now in active movement and some of the water, salts, peptones, and dextrins are being absorbed. The manufacturing of gastric juice now gradually declines toward a point of non-secretion, and less mucus is being delivered from the gastric epithelium. The strength and activity of the peristalsis of the stomach diminish as the organ empties, practically ceasing when this is completed, and after which the gastric mucosa returns to its alkaline and gray-colored appearance.

From the first entrance of the chyme into the duodenum, more important and interesting physiological phenomena take place. In the small intestine the digestion is profound and the resulting products mainly absorbed. This begins at the pylorus and is largely completed by the time the food arrives at the ileocecal valve. The digestion in this part of the canal is effected by the combined action of the three secretions—the pancreatic juice, the secretion from the intestinal glands (succus entericus), and the bile, all of which continue hand in hand.

The acid of the gastric juice probably stands guard over the opening and closing of the pylorus, and also affects the mucosa of the duodenum, producing secretin. This is absorbed by the blood and carried to the pancreas, and stimulates that gland into activity beyond that which had already been started by the mere presence of food in the stomach. This alkaline secretion now neutralizes and then renders neutral (rarely alkaline) the chyme, instituting the enteric digestion and permitting the pylorus to open for a new supply of chyme to the intestine. The first particles of the meal now pass downward in active digestion, due to the enzymes of the pancreatic juice—trypsin, amylopsin and steapsin, and also the secretion of the enteric mucosa.

Trypsin is secreted as trypsinogen, which, when it comes in contact with an activating product of the duodenum membrane called enterokinase, is converted into the active enzyme. This enzyme reduces rapidly and completely the gastric changed or unchanged proteins into proteoses and peptones, which, the erepsin of the succus entericus reduces still further into the amido-acids, the prodromata of the very end-products (polypeptid) for absorption. The amylopsin completes the conversion of the starches which it hydrates into maltose and achroödextrin. Before absorption, these substances are further acted upon by the maltase of the intestinal secretion and are converted into dextrose. The steapsin, assisted by the presence of bile, completes the splitting of the neutral fats into fatty acids and glycerin, and the fatty acid then unites with the alkaline salts present to form soaps. The fatty acids and glycerin are absorbed directly by the epithelium, after which the products are synthetized, by the reversible action of the lipase present in the tissue back again into fat.

All this time when the secretin, enterokinase, and erepsin of the succus entericus are at work, the inverting enzymes of this same juice are converting the disaccharids into monosaccharids—the maltase acts upon the maltose and dextrin converting them into dextrose, invertase upon the cane sugar reducing it to dextrose and levulose, and the lactase changes the milk sugar to dextrose and galactose. In these latter forms all of them are absorbed.

While the pancreatic juice is discharging, bile is also flowing through the same orifice. This secretion carries with it waste products from metabolism (cholesterin, lecithin, and the bile pigments which color the chyme a yellowish-greenish tint) and a substance which facilitates in the entire digestion of fats. The abundant presence and actions of the bile retard the putrefactive changes of the food in the small intestine caused by the bacteria normally present.

Absorption of all of the end-products is now active; the fats by

way of the villi, lacteals and thoracic duct into the blood vascular system, and all the others through the capillaries of the villi into the portal vessels and by way of the liver finally into the blood. When the chyme has arrived at the ileocecal valve (from two to five and a half hours after eating) and while it is passing (from nine to twenty-three hours), about 85 per cent. of the food-products have been fully digested and absorbed.

The remainder of the meal is now in the large intestine, where it comes in contact with the alkaline and mucus-charged secretion of the colon which is free from enzymes. Here that much of the unabsorbed food that has passed the ileocecal valve and the water of the chyme, which is still about as fluid as at the pylorus, are passed up and down the ascending colon by peristaltic and antiperistaltic movements and are absorbed, leaving feces, which consists of indigestible food materials, some of the food-products untouched by the intestinal secretions, cholesterin, excretin, mucus, pigment, inorganic salts, a large quantity of bacteria, and the end-products of putrefaction (phenol, indol, skatol, cresol, etc.). It may finally be mentioned that there is normally a minor degree of bacterial action in the small intestine; most of the putrefaction, however, takes place in the large. In the small gut there is usually some bacterial effect on the carbohydrates and also on the proteins if they are not quickly absorbed. The feces collects in the sigmoid and rectum, where its pressure upon the sensory nerves produces the desire to defecate, which is brought about by relaxation of the internal sphincter of the anal opening and the contraction of the abdominal muscles.

FOODS AND FOODSTUFFS.

As the body is composed of the chemical constituents or proximate principles of proteids, carbohydrates, fats, water and salts, in order that nutrition of the body may proceed normally, these principles in proper proportions and quantities must be supplied. This permits of the use of a great variety of products of the animal and vegetable kingdoms, and as man is an omnivorous animal and Nature has developed in him the physiological necessities to digest them to maintain life in its fullest capacity, all of them are necessary. It must never be forgotten that while man may exist on a one-sided diet (vegetables), it is not altogether what we eat but what we digest and absorb that maintains the exothermic changes of life, and also the important fact that the proteins of animal foods are more completely digested than those of the vegetable kingdom.

The animal foods, particularly the meats, are characterized by their large quantity of proteins and fats, and a relatively small amount of carbohydrates. The meats themselves differ considerably in their protein content as the following list shows. The vegetables are distinguished, as a rule, by their large percentage of carbohydrates and small amounts of proteins and fats. Some of them, however (such as pease, beans and other leguminous foods) are remarkable for their large percentage of protein. The cereals occupy a place between the two groups above mentioned.

COMPOSITION OF DIFFERENT MEATS. (Taken from Koming's and Atwater's analyses.)

	Water.	*Protein.*	*Fat.*	*Carbohydrate.*	*Ash.*
Beef, moderately fat	73.03	20.96	5.41	0.46	1.14
Veal, fat	72.31	18.88	7.41	0.07	1.33
Mutton, moderately fat.....	75.99	17.11	5.97	....	1.33
Pork, lean	72.57	20.05	6.81	....	1.10
Ham, salted	62.58	22.32	8.68	....	6.42
Pork (bacon), very fat	10.00	3.00	80.50	....	6.5

In the class of proteins are also included such other substances than muscular tissue of animals as various glands (thymus, testicles, spleen, etc.), brain, lung, liver, and so forth. Birds and fish foods, oysters, clams, lobsters, etc., are also included in this class. The digestibility of the protein foods depends much upon their quality, quantity ingested, and preparation. The younger animals supply the tenderest and easiest digested flesh. That which is too fresh (still rigid) or contains much fascia, tendons, etc., is tougher and more difficult to digest. Raw meat is more easily digested than that which has been cooked; and chopping, scraping, or grinding the meats increases its digestibility. Cooking, however, diminishes the danger of infection by the destruction by heat on the contained micro-organisms. As the cooking of meats coagulates their nitrogenous matter (myosin) and contained blood, it must be plainly evident that any extract of these foods, when heat is used in the process (beef-tea, other meat and fish food broths), contains but little protein matter and therefore is quite valueless as a food. Unless some of the carbohydrates, such as the vegetables gumbo, tomato, celery, etc., or the cereals, such as rice, sago, farina, tapioca, etc., are added to these broths, they are little more than water, salts, and some soluble extractives of meat (gelatin and a little albumin), and, beyond a stimulating effect, are of but little value as foods for the well or ill. Some forms of cooking, as roasting or broiling, loosen up the various fascia and

enveloping membranes, thereby separating the fibers so that the digestive juices can act more easily upon the fibers themselves.

Eggs are especially rich in protein and fats. They are an excellent article of diet because they are so easily digested. The more they are cooked, the harder the protein in the white of egg becomes, and the slower they are of digestion. From the soft to the hard boiled variety the difference in time is about double—the soft leaving the stomach in about one and a half hours. Still, the writer has had persons who could digest hard boiled eggs without distress, and in whom the distress resulting from taking the soft forms prohibited their use. The caloric value of two eggs is about twenty calories; about equal to the heat value of a tumbler of milk.

Milk is the most perfect food extant. It possesses all of the elements necessary to maintain life and is quickly and readily digested leaving no indigestible residue. As mother's milk, it is the ideal food for the young; as cow's milk, with its greater protein content, it is the ideal food for the adult. Its casein and albumin are easy of digestion, its fats are in the form of a fine emulsion and thus readily reduced, its carbohydrate (lactose) has a special enzyme in the enteric canal for its conversion, and its water and inorganic salts are readily absorbed into the economy. For these, and the fact that it can so easily be sterilized, it makes an ideal and safe food for the sick.

Among the various modifications of milk that are used are:—

Kephyr—cow's milk fermented by kephyr grains.
Kumiss—fermented mare's milk.
Matzoon—cow's milk fermented by yeast and lactic acid bacilli.
Cream—which is mostly fat and some casein about the globules.
Butter—the fats without this casein envelope and fluid.
Buttermilk—the fluid of the cream containing this casein.
Whey—the fluid of milk without the casein, but containing the salts, sugar and milk albumin.
Cheese—which is the precipitated casein with more or less fat, according as cheese is made from skimmed, whole milk, or whole milk plus cream.

The vegetable foods all contain more or less carbohydrates. Those particularly rich in proteids are the leguminous foods: pease, beans, lentils, etc. These contain about twenty-five per cent. of legumin, which is allied in its chemistry to albumin. They form the chief source of nitrogen in the vegetarian dietaries. Some of them, like potatoes and rice, are relatively rich in starch and sugar. The green vegetables, asparagus, cabbage, spinach, string beans, etc., are especially rich in salts; while fruits, pears, peaches, grapes, apples, etc., all contain considerable sugar and organic acids, like tartaric,

malic, citric, and others. Ground cereals make up a significant bulk of carbohydrate diet (wheat, rye, rice, barley, oats, etc.). Some of these, like oats, are rich in starches, while others, like wheat, contain a protein called gluten and fats in considerable quantities and are valuable nitrogenous substances. Those that contain mostly starches are ground up into flour, which in turn, by the addition of other substances, like yeast, carbonic acid gas, baking powder and so on, are developed into various articles of food (bread, cakes, biscuits, macaroni, sago, etc.).

COMPOSITION OF FOODS. (HOWELL.)

In 100 Parts.	Water.	Protein.	Fat.	Carbohydrate.		Ash.
				Digestibles.	Cellulose.	
Meat	76.7	20.8	1.5	0.3		1.3
Eggs	73.7	12.6	12.1			1.1
Cheese	36 to 60	25 to 33	7 to 30	3 to 7		3 to 4
Cow's milk	87.7	3.4	3.2	4.8		0 7
Human milk	89.7	2.0	3.1	5.0		0.2
Wheat flour	13.3	10.2	0.9	74.8	0.3	0.5
Wheat bread	35.6	7.1	0.2	55.5	0.3	1.1
Rye flour	13.7	11.5	2.1	69.7	1.6	1.4
Rye bread	42.3	6.1	0.4	49.2	0.5	1.5
Rice	13.1	7.0	0.9	77.4	0.6	1.0
Corn	13.1	9.9	4.6	68.4	2.5	1.5
Macaroni	10 1	9.0	0.3	79.0	0.3	0.5
Pease, beans, lentils	12 to 15	23 to 26	1½ to 2	49 to 54	4 to 7	2 to 3
Potatoes	75.5	2.0	0.2	20.6	0.7	1.0
Carrots	87.1	1.0	0.2	9.3	1.4	0.9
Cabbages	90.0	2 to 3	0.5	4 to 6	1 to 2	1.3
Mushrooms	73 to 91	4 to 8	0.5	3 to 12	1 to 5	1 2
Fruit	84.0	0.5		10.0	4.0	0.5

ACCESSORY ARTICLES OF FOOD.

In addition to the ordinary foods, there is a series of articles which are frequently used but are not essential to maintain life. Among the most used of them are: alcohol and various drinks, tea, coffee, cocoa,—and the condiments.

Alcohol is used in a great variety of drinks. Beer contains from 3 to 5 per cent. of alcohol, and about 6 per cent. of extractives, prominent among which are dextrin, maltose and albuminoses. Wines contain from 6 to 25 per cent. of alcohol; port about 10, and sherry up to 25 per cent. In addition, the wines contain considerable sugar and free organic acids. Spirits contain about 50 per cent. of alcohol.

In small amounts and in dilution of under 10 per cent., ethyl alcohol acts as a stimulant to the secretion of hydrochloric acid, but no effect is noticed on the amounts of pepsin or gastric mucus. In

stronger solutions, 20 per cent., the secretion of gastric juice is more actively stimulated with an increase in the production of mucus. In higher concentration the secretion is inhibited and shortened, while the formation of mucus is marked. Over 50 per cent. alcohol produces abundant mucous secretion with very little hydrochloric acid formation. Above 70 per cent. it has a corrosive action on the mucous membrane through its disintegrating effect upon the albumin in the cells. (L. Kast[3]).

Like alcohol in small quantities, tea, coffee, cocoa are all stimulants. This is due to the alkaloids contained in them. Tea has in addition an astringent of the nature of tannin. The alkaloid of coffee (there are about 2 grains of caffeine in each cup) with a volatile oil called coffeon makes this beverage strongly stimulating to the nervous system and kidneys. Cocoa also contains fats (60 per cent.), starch and albuminous matter, and thus must be looked upon more as a food than the others.

Among the condiments are pepper, salt, mustard, vinegar, paprika, etc., and the flavors, which are various oils or esters that give odor or taste to food or drink. As a group it may be said about them that they occupy an important place in the régime of feeding, and are valuable in the way of rendering foods more palatable. In the quantities in which they are usually taken they are not injurious, at least not to any appreciable extent on the normal stomach.

NUTRITION AND HEAT PRODUCTION.

In completing this chapter it seems not amiss to include some of the established facts concerning the aim of alimentation, metabolism, heat production, and so on, as they appear in importance. For the sake of brevity in outlining these varied and complex processes, it would be best to consider them under the foodstuff headings—such as the proteins, albuminoids, carbohydrates, fats, water, etc.—and call attention to certain general physiological conceptions regarding them.

In the process of the metabolization of proteins (and albuminoids), for the purpose of tissue nutrition and repair incident to function, organic substances are chemically changed, and nitrogen, which is a component of the original body, is eliminated. This is found in the urine, feces, and sweat. When the body is receiving the food, as much nitrogen (or protein) as is metabolized and excreted, the body is said to be in nitrogen equilibrium. In adult life, under normal conditions, the diet is so regulated by the appetite, that a nitrogen equilibrium is maintained through long periods of time. If there is a

plus balance in favor of food, the body is laying on or storing protein tissue; while if the balance is minus, the body is losing protein and therefore weight. In this connection, it is important to remember that under favorable conditions for its development, a body can establish the nitrogen or protein equilibrium at different levels without any apparent effect for the time being. But a long continued too high an intake is liable to cause gastro-enteric and corporeal conditions of illness; while one that would be too low would cause subnutrition, anemia, etc. During growth in the young, in convalescence, etc., the body stores protein and the balance is in favor of the food nitrogen.

Likewise it is important that the carbon equilibrium must also be maintained to preserve health in the body. The carbon is excreted in the exhaled air, urea, etc., and this output is also balanced by the carbon intake of the food. It is possible that a body could be in nitrogen equilibrium and yet lose or gain in weight, because the nitrogen intake and output may be balanced while the carbon, which is derived mostly from the hydrocarbons and carbohydrates, may be lesser or greater as the case may be. A normal person lives so as to maintain a general body equilibrium (includes also water and inorganic salts). His intake must balance his output so that he can carry on the functions of life and his mental and manual work without losing weight and strength. The non-protein foods can act as protector to the proteins. Herein lies their great value in nutrition. On a mixed protein and non-protein diet, the latter may be increased and the former markedly decreased without there being a breaking down of the nitrogen equilibrium. This is apparent when we remember that the proteins furnish heat-energy to the body, and that parts of them are used to reconstruct the living protoplasm which breaks down in the functional work of the tissues. The non-proteins are strong heat- and work-energy furnishers, and, by saving this necessity on the part of the proteins, can permit them to enter mostly into the reconstruction of the tissues.

The examination of the dietaries of the civilized races shows that between 100 to 120 grammes of proteins are used daily by the average adult man. Chittenden claims, based on a number of careful observations, that Voit's standard of 118 grammes was too high, and that men in various walks of life may be well nourished, without losing weight or strength, on a diet containing only 30 to 50 grammes of protein. While this may be true and of interest from a physiological point of view, it is wisdom for the physician not to set it up as a standard for application to those who are ill, unless he adds to the low protein dietary a sufficient quantity of easily digested "protein-sparers" to

keep the protein quota high enough for full nutrition. In diseases like the continuous fevers and in some gastric disorders in which it might be advisable for evident reasons to seriously curtail for the time being the quantities of ingested foods (gastric atonies), the low protein standard might be of service as a safe minimum standard in making up a dietary. In many of the gastric disorders of an organic nature (non-malignant), the patients suffer from subnutrition from the taking of too little food, and a higher feeding of proteins, like that now so successfully employed in the treatment of tuberculosis, constitutes an important factor in the embetterment and the holding well their general and local condition.

The albuminoid most frequently occurring in food is gelatin. It is derived from the connective tissue in meat, bones, etc. Observations have conclusively shown that although gelatin most resembles the proteins, and that it is formed into peptone during digestion, it cannot maintain nitrogen equilibrium. Gelatin serves as a source of energy to the body in about the same sense as the carbohydrates and fats do, excepting that it is a better protein-sparer than they are.

The carbohydrates, sugars, starches, gums, etc., are reduced in the processes of digestion and absorbed into the blood as simple sugars (dextrose, levulose, galactose). Here they are formed into glycogen in which form they are stored in the muscular tissue and liver and finally are utilized in the economy as dextrose. Most probably the liver is the storehouse and regulator of this supply to the blood. Physiologists assume that in regulating this, the liver-cells produce an enzyme which converts the stored glycogen into dextrose in proportion as the sugar of the blood is used up by the tissues. The end-products of carbohydrate oxidation are carbon dioxide and water, and the probability is, that in some way the internal secretion of the pancreas is essential to the process, of which it may be said that there is still much to be learned in the way of how this is brought about and the chemistry of the intermediate products.

The great value of carbohydrate foods lies in their being a source of energy for muscular work (the oxidation of the muscle glycogen furnishes the main or sole source of element for muscular contraction). By their oxidation they furnish a most important part of the constant supply of heat in the body (each gramme of sugar on oxidation yields 4 calories of heat), and the oxidation of sugar saves the loss of protein. It is evident, then, that the carbohydrates are important sources of heat and energy, but have no direct effect upon the building of the protoplasm of the body. In fact a person fed only on strict carbohydrate food would eventually starve to death. There is little doubt

that in the indirect way, as protein-sparers, they are more efficient than the fats. The carbohydrates again, are important factors in the building up of fat in the body, and the fat which is synthesized from them is of the firm and more staple kind. Since in the forms that they are usually taken as foods they are so readily digested and absorbed, they comprise an important factor in the dietaries of those who are under-nourished and debilitated—a common picture in many of our long standing gastric cases.

As has already been pointed out, the fats are broken down in the process of digestion into fatty acid and glycerin, which two products are immediately resynthesized in the villi into neutral fat again, in which form it circulates in the lacteal system (the so-called chyle fat). The fats are the main sources of energy to the body—even beyond that possible by the same weight of carbohydrates. When eaten and absorbed in amounts in excess of the metabolic necessities, it is stored in the adipose tissue as fat which is readily available for oxidation for conditions of need, such as, insufficient diet, illness, starvation, etc. In addition to their sources of heat-energy, both immediately or after they had been stored, they may be synthesized with other complex substances of the body, such as lecithin. It is probable that they are not factors in the production of body sugar in any way, even under conditions of starvation. But on the other hand, fat can easily and often is produced from sugar in the body—this is plainly seen in those heavy individuals who practically live on fat-free diets, but who partake largely of carbohydrates.

The body contains in its structure a considerable amount of inorganic materials. On incineration of the body this amounts to about one per cent. of the total weight. These are not sources of heat-energy but, nevertheless, they have most important functions. They maintain a normal composition and osmotic pressure in the controlling of water to and from the tissues; they are bound up in the living molecule and are necessary for their construction and normal reactions; the calcium salts are important in the coagulation of the blood and the coagulation of milk; the calcium, sodium and potassium salts in the actions of the heart and irritability of the muscular and nervous tissues; the iron salts for the production of hemoglobin; and the chlorides for their assistance in osmosis, secretion and excretion.

References.

[1] Howell: "Text-book on Physiology," second edition, p. 680.
[2] Kastle and Loewenhart: American Chemical Journal, 24, 491, 1900.
[3] L. Kast: Archiv f. Verdauungskrankheiten, 1906, xii, Nr. 6.

CHAPTER IV.

Anamnesis.

THE interrogation of the patient, the history taker's ability to discern and marshal salient points and reject those which are superfluous, is of the greatest value in gastro-intestinal conditions as well as in all other clinical work. It is hardly necessary to again state the oft-told fact that an exhaustive history is of the utmost importance, but such matter as is noted in writing must always be relevant to the illness itself, and not include all that most patients tell us. It can hardly be expected that a lay person could delineate a consecutive medical history. This ideal is rarely met with even when a physician or trained nurse is the patient before us. Common errors, in my experience, are the absence on the part of the patient to attention to general anamnesis, the tendency of persons to lay special stress upon relatively unimportant matters, the rambling off in directions which serve to no purpose in the way of diagnosing the condition which brings them under observation, and the ever present fact that the average person is not observing of himself in the detail way and thus attaches no or but slight importance to many valuable clinical details.

For this reason, I usually begin the interview with the question, "In what way do you seem to be ill?" My purpose in this, is to serve in roughly distinguishing between gastro-intestinal conditions proper, and conditions of disease remote to the alimentary canal. While this is not offered as a practice in the separating of the cases, it is of practical value as a time saver, and permits one to make mental deductions of the patient's appearance, manner, voice, his aptitude to center on classes of symptoms, the listening to matters of history which might be the pivotal points for elucidating subsequent relevant details, and so on. I believe it is always the best plan to encourage this preliminary talk before the details of the building up of the history record is begun in earnest. The majority of those seeking advice are quite willing to give a report of their distress at the onset of the interview, which narration, it can be said, can easily be stopped by the simple interjection of a question or two should it be noted that

but little more of importance could come spontaneously. Quite naturally, the subjective symptoms receive the sway of attention, and the objective ones, unless they are prominent features in the case, but scant notice. In a few moments, a general atmosphere of the case and the individual will be noted, and an idea will occur as to whether the patient's detail of symptoms can be accepted, or to what extent, or whether it would be wisest to request of the individual to simply answer the questions as you ask them. At this point the history is begun in detail, and the subject matter written upon history cards or blanks kept for that purpose. At the recording of the history it is well to become master of the situation and, having in mind the individual's past remarks as they bear upon the illness, build up the history in a deliberate manner. Manifestly, it would not be expected in this work to canvass the symptomatology of all of internal medicine. The author wishes merely to give a few simple guides with the hope that the important matter of good history taking may be more generally recognized and possibly benefited in at least so far as it pertains to gastro-enterological conditions. My observation has been that assistants who have graduated from properly conducted hospitals —particularly those of our large cities—are more alive to the importance of good histories, and are more able in the construction of them than those who have not been so fortunate. This alone tells its own story, to which, of course, it must be added that personal equation makes differences in all. The following questions are offered in the way of suggestion.

Age, avocation and mode of life?

Are you of a nervous nature? Details on family history and points from direct observation are important.

What previous illnesses have you had? What are your habits in the use of alcoholic drinks, tea, coffee, and tobacco?

Mode of onset of symptoms sudden or gradual?

Was there an infectious disease or any disturbed state of body accompanying or immediately preceding its onset? Any other cause, such as fright, worry, taking cold, trauma? When did your illness begin? What were the first symptoms noted, and how have these changed since then?

What is your usual weight, and have you maintained, lost or added to it? Always weigh patients yourself to prove that their statements are correct.

Have you lost in physical strength since your illness, and how have you noted it?

How is your appetite now? Is it regular, increased, lost, variable, easily satisfied, or have you a desire for piquant foods?

Is your thirst increased, and how do you feel after drinking hot or cold drinks?

Have you an unpleasant taste in the mouth? Is it pappy, sweet, sour, bitter

or foul? Is it only present or is it most noticeable mornings, or present only after meals, and if so, how long after?

What are your eating habits in numbers of meals, kinds of foods you partake the most of, and how much time do you usually take to eat your meals?

Do disturbances of swallowing or symptoms of dysphagia exist? And if so, find out their character. Is there a globus hystericus, or vomiting of foods collected in the esophagus? What kind of foods can be swallowed the easiest, or cannot at at all—solid, semisolid, fluid. Have you catarrh in the head, and do you have much throat trouble?

Have you a feeling of pressure in your stomach? At what point do you feel it, does it come on only after eating, and how soon afterward, or is it independent of the ingestion of foods? How long does it last, and do certain kinds of food or quantity of them have any influence upon it? Have there been periods of time in the past when it was not present?

Have you actual pain in the stomach, or just distress? What is its relationship to meals, quantity or quality of foods? When after eating does it occur, how long does it last, and exactly where is it situated? What is the character of this pain, and does motion or posture influence it?

Are you troubled with decided belching of gas, and what is its relationship to eating? Is it odorless or not, and has it a taste? Do small amounts of food come up with the gas? How long does this last after eating, and have you had intervals of relief and return in the past? Is there trouble with gas or rumbling in the intestines?

Is nausea present, how long does it persist, what is its relationship to meals or an empty stomach, and how long have you had it? Do you vomit? If so, what have you vomited—ever blood, bile, mucus, fecal substance, etc? When does it come on; after meals, between times, nights, or early mornings? Is this vomiting a rather constant feature, or only rarely present? What have been the sensations in your stomach before and after it had occurred? Is this collective vomiting?

What is the condition of your bowels in the way of daily movements? What is the consistency, color, and character of your stools? Are the stools accompanied by pain? If diarrhea exists, how frequent and what is the character of the discharges? Do you have pain or rumbling when your bowels move? Does the diarrhea alternate with constipation? Do you ever pass mucus? If necessary examine the anus, rectum and sigmoid.

As was stated before, the above are only suggestions. As certain seemingly important symptoms are given, it is advisable to accept them in a pivotal sense and seek by correlative symptoms to confirm them. A primary rule of evident value is not to build up a history on symptoms that do not exist. Better by far to have a short succinct record than one in which the important points are lost in a turgescence of non-essentials. Exceptions to this may be made when negative record of large organs, cavities, or laboratory reports is to be included. That is to say, such brief terms as, "heart and lungs neg.," "blood, urine, feces, sputum neg.," and so on, are permissible, but the

not present subjective and non-important personally noted objective, together with unimportant not-finds of your own, had best be left out.

The diagnostic value of points in the history are plainly evident, and it might further be said, that conversely, a disconnected, questioned, or barren history may be confirmatory value when some of the commonly seen neurotic affections are under observation for treatment. Considering the important points in more detail with a general idea of their relative importance to diagnosis the following is offered.

Age, and avocation are important factors. In infants, children, youth, and young girl ages, the gastro-intestinal affections due to indiscretions in diet are by far the most common. Most of these are of an acute nature and are simple catarrhal or toxic conditions in which cause can easily be obtained. Hygienic factors pertaining to their mode of life, and present general states of body are of course important, since it is true that the young are more susceptible to bad effects from errors in feeding than adults. The neuroses are most common in those of the second and third decade who are engaged in active life. Acute gastric ulcers of the clinical type are more common in those right after puberty and up to the third decade; chronic ulcers and carcinoma are usually seen later in life. Sarcoma of the gastro-enteron may occur at any time from puberty on. Chronic gastritis is mostly a disease of adult life, beginning at any period.

Avocation and mode of life have a strong importance in the history. In such patients as are daily employed indoors, book-keepers, sales clerks behind counters, typewriters, seamstresses, sewing-machine workers in factories, and so on, from their sedentary employment are especially prone to constipation and conditions of low and perverted digestion. In the adult, sufficient manual exercise and fresh air are important factors of maintaining good digestion, assimilation, and metabolism. In the young and aged these may be said to be not so essential although still important. The same may be said of those in higher walks of life, such as business people who conduct their affairs from desk chairs, and men and women in whom employment in business is unnecessary to livelihood. Particularly in the women of the better classes, a medley of metabolic and neurotic disturbances exist because of the physically inactive and vitality robbing lives that some live. Those who ride through life in carriages arrive quicker at the grave than those who walk. In such as these, late rising, late retiring, and heavy eating are commonly present, and it is no wonder that such artificial lives should be more susceptible and beset with worry, anxiety, mental strain incident to social, domestic

and physical affairs than in those less fortunate in the worldly way. Important also is it to recall that gastro-intestinal symptoms may be present in workers in metals, as moulders and finishers of soft metals, painter's (lead), colored papers and artificial flowers (arsenic), also those subjected to inhaling coal gas, and in the drug habitués, particularly morphinism. Among habitual "diners out," and "good fellows" of men, chronic gastritis, intestinal and metabolic disturbances are common. In constantly well-dressed women conditions of ptosis are often observed. In those whose work causes rather constant pressure upon the epigastrium (shoemakers, etc.) gastric ulcer may exist.

The acute gastric ulcer is the most common in women, and chronic gastritis in men. In women, ptosis and the true psychic and neurotic disturbances are most commonly found. According to my records, myasthenic and atonic states of the stomach predominate in men, while cancer is about evenly divided. Quite naturally those who racially, by family inheritance, or disposition, are of a "nervous nature" would be more prone to the neurotic and neurasthenic states.

Evident is the value of history of previous illness. Many digestive disturbances accompany, follow, or are made worse, by states of general illness. Also of some service in the diagnostic, prognostic, and therapeutic way is a history of gastric disturbance in the past interspersed with periods of relief, for such are liable to be the more chronic affections. The state of the now present digestive disturbances should always be matched in character and severity ot symptoms with those that were present in attacks before, and, as these may present differences, those of late changes or the establishment of resulting or new conditions, may be suggested. Excessive use of alcoholic drinks is very liable to result in chronic gastritis; excessive coffee and tea drinking in the local or general neurotic affections, and the heavy use of tobacco in the irritative sensory, secretory and myasthenic states and in general neurotic and circulatory disturbances.

Mode of onset is of value particularly in the suddenness of acute ulcered conditions. The organic diseases establish themselves much slower, while the malignant and so-called functional disturbances occupy a place between the two. The ptosis conditions usually cause the establishment of subjective symptoms over longer periods, although there may be an acute onset due to a quick overthrow of the neurotic, secretory and dynamic balance—particularly is this so in the post-puerperal cases. The cases of increased gastric secretion and atonic states usually give an irregularly running history, interspersed with sharp, acute attacks. True sensory conditions of the severer

types establish themselves quickly, while the secretory and motor are more subacute or chronic. Post-surgical gastric dilations are most acute.

Any state of illness which causes a loss of weight, physical strength, and vitality is always a serious condition. When this is distinctly due to organic change in the gastro-enteron and interference with the processes of digestion (and therefore assimilation and metabolism) and not to foolish low dieting, its importance is plain. In ulcers and functional disturbances loss of weight is not the rule. In well established chronic gastritis and in cancer, sarcoma, and primary atonies, it is.

Loss of appetite may be caused by any affection of the digestive tract, surfeit of foods, emotions, and disease elsewhere in the body. It is, however, a most constant symptom of stomach conditions, much more so than states of variable desire for food and drink and those of bulimia, polyphagia, and acoria in which the desire is abnormally increased and much of the normal satiety from eating may be lost. Clinically, the distinctions between bulimia, polyphagia and acoria are of little practical value. They all usually accompany functional neurological, or organic diseases of the brain, or diseases or states of low metabolism; among such may be mentioned, hysteria, neurasthenia, epilepsy, hydrocephalus, cerebral tumors, Graves's disease, sexual affections, diabetes mellitus, etc. Bulimia is the permanent condition, polyphagia is paroxysmal, and acoria that in which a feeling of "emptiness" follows abundant feeding. The term pica is used for the craving of unusual or injurious substances, possibly of a repulsive nature (coprophagy). These usually accompany the insanities or idiocy, although less marked perversions of normal desires may be seen in chloro-anemia, pregnancy, hysteria, and the capriciousness of childhood.

The appetite is generally lessened in cancer, atrophy of the stomach and in states of chronic gastritis; this is also true in amyloid degeneration, certain psychic and neurotic states both local and general, often in ptosis, and sometimes in myasthenia. In gastric ulcer the appetite remains unaffected, while in the height of and throughout the toxic and suppurating conditions and in the intense sensory disturbances and anorexia nervosa, it is lost. In the average clinical run of chronic gastritis, primary atonies, and neurotic gastric conditions, it is usually variable running all the way from complete anorexia and aversion to foods to acoria. Anorexia is present in epidemic influenza, pyrexia, chronic pulmonary tuberculosis, suppurations, debilitating and wasting disease, in early convalescence, in

dyspeptics who practise self-prescribed abstinence, and in those who are worried, stricken with grief, anxiety, or suspense.

Too much importance must not be attached to loss of appetite in gastric disease, and practically states of present digestive function cannot be deducted from it. I have frequently seen a healthy appetite existent under conditions of marked digestive disorder, and again found it much affected when no actual functional or organic disease existed. Thirst, however, is commonly present in states of disturbed motility, atony, and gastric neuroses, and is a more constant and reliable symptom. It is present in profuse watery discharges from the bowels from any cause, hemorrhage, toxic gastritis, diabetes mellitus and insipidus, and in the dry mouth of xerostomia.

The condition of taste is of some value. The taste is pappy or insipid in chronic gastritis, bitter in jaundice and carcinoma, acid in states of increased gastric secretion, and sweet in diabetes mellitus. The condition of the mouth and nose has much to do with bad taste and breath. Among causative conditions may be mentioned carious teeth, periodontitis, tonsillar deposits, unclean condition of the tongue, coryza, polypus, ozena, etc. Purely subjective perversions of taste (parageusia) are usually indicative of hysteria, insanity, or the aura of epilepsy.

Details of eating habits may give information which is of diagnostic value. Excessive feeding for the physical and mental needs of the individual means a tax on the digestive capacity and the overloading of the intestines with toxins from which metabolic disturbances and their aftermaths might ensue. Overeating often accompanies overindulgence in alcoholic drinks, coffee, tobacco, and so on, and these may develop atonic and catarrhal conditions. The character of foods habitually taken and the manner in which they are cooked and served are of importance to note. Together with the number of meals taken daily, is the time usually given in the eating of them. Hasty eating usually means insufficient chewing, and, with the low amount of saliva ingested (ptyalin), an added tax is put upon the digestion in the disintegrating of solid substances (like meat, fowl, and so on), and also the gastric conversion of starches is limited. These usually cause local neurotic, low forms of catarrhal, and atonic states, together with the effects these have on intestinal digestion and the nutritional condition of the general body.

More or less pronounced states of dysphagia must be minutely analyzed. The common response "the food sticks in my throat and don't seem to go down," or when designating the low sternal region they say "it lodges and presses here after swallowing," are far short

of subjective evidences of stenotic conditions in the gullet or cardia. The false condition of globus hystericus should always be ascertained by detailed cross-questions; the same may be said of esophageal and cardiospasms. The existence of the true stenotic conditions can usually be learned from the history when such stenoses are well established, remembering always that the fluid and semisolid foods are the most easily and quickly delivered into the stomach. Collective vomiting from the esophagus or a diverticulum is important. Many patients complain of difficulty in swallowing who have pharyngitis sicca or other faucial conditions.

Distress or pressure in the stomach after meals is the most constant symptom of gastric disturbance. This with pain and vomiting are the cardinal symptoms which bring most of the cases under observation. It is even more common than the two latter since it is present in the minor as well as the severe affections. In the mild forms of gastric disturbance the sensation is not as severe, constant, or long continued after eating as in the extreme forms. The cases in which it occurs quickly after ingestion are those in which the mere presence of foods in the organ is its exciting cause. Among these may be mentioned the true gastric neuroses in which the stomach is hypersensitive from neurotic or irritable states, and those in which the weight of foods or drink drags it down. Such would be found in the neurotic states of neurasthenia gastrica, mild types of gastralgia and hyperesthesia, and in the latter group, in simple gastric myasthenia, atonic ectasia, the lesser forms of true yet irregular types of neurotic motor disturbances, ptosis, etc. Those in which post-meal distress occurs later are apt to be due to the effects of the acid secretion on the organ, the presence of gastric mucus interfering with proper digestion, the functional breaking down of the normal digestive balance in the course of digestion, or those in which foods and the gastric secretion in the course of time become irritating to localized diseased surface. The sensation of distress may also be due to an increase above the amounts of normal fermentation, congestive swelling of the liver, or may be reflex from other diseases or conditions existent elsewhere in the body. Quite naturally, any true gastric case which gives a transitory history of pressure or distress after meals is more liable to be a functional or catarrhal disturbance than one in which ulcer or cancer is present.

Actual pain in the epigastrium is a most reliable symptom and one of much importance. A clinical distinction between this and states of distress is of much moment. With pain, as with most subjective symptoms, the personal equation to distinguish the difference

between it and only distress or pressure and the matter of tolerance present wide varieties between people. But when actual pain exists, either following digestion or when the stomach might be supposed to be empty, it usually means *bona fide* trouble, and close details on the history of it are of much value. Among gastric cases in which it is localized in the epigastrium may be mentioned ulcer, cancer, the intense sensory neuroses such as hyperesthesia and gastralgia, gastritis both acute and chronic, erosions, the orifice and stomach spasms, gastroptosis, etc. Among causes other than diseases of the stomach which may give local or more diffuse abdominal pain may be mentioned enteralgia, enteritis, lead colic, arsenical and mercurial poisoning, floating kidney (Dietel's crises), intestinal colic, obstruction, perforation, peritonitis, sudden hernia, rheumatism of the abdominal walls and lumbago, embolism of the superior mesenteric artery, abdominal neuralgia, acute pancreatitis, locomotor ataxia, and others.

It is important to obtain information as to the relationship of pain to the ingestion of foods, and to its site. When it is always present (whether the stomach is empty or full) in a cancer case, the growth is usually at the pylorus, and in the intense sharply localized types coming definitely and constantly after eating (particularly coarse foods) it is strongly suspicious of ulcer in the stomach or duodenum. In gastric ulcer, it usually comes on within the first hour, and in duodenal ulcer occasionally in the second after eating. Cases of even multiple ulcer may exist without pain (this should not be forgotten). In cases of increased secretion (hyperchlorhydria) the pain, or its forerunner, marked distress, comes on when the food is saturated with hydrochloric acid beyond its amount or chemical character—usually occurring one to three hours after eating. Also, a markedly acute pain coming on immediately after eating is present in gastralgia or acute gastritis. Those which come on at off times, independent of meals, are suspicious as due to locomotor ataxia, Dietel's crises, or gastroxynsis.

Marked acute states of belching of gas are strongly suspicious of neurotic disturbances or those due to simple dietetic indiscretions. Those conditions in which it is constantly present to a slight degree are found in chronic gastritis, cancer, the persistent neuroses and atony. As to the taste of the gas, certain points are of value. An acid taste coming on one or two hours after meals suggests increased gastric secretion, and when this is at off times, a more or less continuous secretion of gastric juice. Bitter and foul tasting gases are often present in running history in states of gastric stagnation and

irregular fermentation and putrefaction; bile in the stomach will also cause it, although here it is of shorter duration in the case. Detail points are of value in this symptom of belching to separate the acute, neurotic, and mildly running chronic cases from the pronounced organic or malignant diseases. Such symptoms as "restlessness," "roaring in the stomach," and "all gone feeling," usually accompany the neurotic disturbances or catarrhal conditions.

Nausea occurs in a large number of gastric diseases and is a common symptom in chronic gastritis. It is commonly present in moderately advanced cancer in which, later on, vomiting is also added to it; here it may be independent of taking foods. It may exist in myasthenic and atonic states, in the neuroses to a less degree, and in tapeworm as long as the worm is present in large size. When it comes on acutely it represents acute gastric disturbance, and when continuing from an empty stomach, cancer, the gastric neuroses or other diseases of the body, such as anemia, menopause, the onset of the exanthemata, or fevers. It is rather a constant symptom upon which too much reliance cannot be placed unless it is present with vomiting.

Details regarding vomiting should never be omitted from the history. Note should be made when it takes place, for that which occurs rather constantly after eating usually means organic disease in the gastro-enteron. Simple regurgitation of food or fluid or rumination should be distinguished from true vomiting, since they belong, when vomiting is absent, to the less severe affections. Leaving out of consideration those diseases which are ushered in by vomiting or accompanied by it, it is a symptom of much importance in gastric cancer, ulcer, the benign stenosis, hour glass contraction, acute and sometimes chronic gastritis, gastroptosis, occasionally in primary atony, in acute surgical dilatation in gastro-chylorrhea, benign tumors, inflammations and adhesions of the stomach, intestines and inner abdomen, etc. It occurs as a constant symptom in gastric ulcer, usually coming on after the ingestion of food and in connection with the characteristic pains. In the insidious or chronic forms of ulcer it may be absent. In late cancer and other causes of pyloric stenosis it manifests itself as collective vomiting; in the atonies, at the height of digestion from the disproportion between the dynamic power of the stomach and the quantity of gastric contents; in chronic gastritis, late in the meal, when the stomach is empty of foods, or only in the mornings; in high and continued secretions, when much overproduced gastric juice is present in the stomach without food; in acute gastritis to empty the stomach of its offending contents; in gastroptosis, tumors, and adhe-

sions for dynamic reasons. Added to these are the instances of vomiting from toxic products in the circulation from medical causes, and reflex vomiting from the neurological system as these may be produced directly from toxins absorbed from the gastro-intestinal canal.

The vomiting of watery fluid or mucus usually indicates chronic gastritis or that much mucus had been swallowed and subsequently ejected from an otherwise empty stomach. If the mucus is clear and of a sour smell its examination usually shows the presence of hydrochloric acid, and thus may be due to hypersecretion, other neurotic conditions, terminal vomiting of migraine, hysteria, movable kidney, and gastric ulcer. Bile-stained fluid is common in any acute case where constant vomiting is a feature. It may be seen in relaxed conditions of the pylorus and where perigastric adhesions interfere with the proper function of the pyloric muscle. It is a symptom of value in ileus or other states of intestinal obstruction, and peritonitis. In these conditions it often precedes fecal vomiting.

Hematemesis, of course, is a type of vomiting of supreme importance. When the blood is bright red it indicates recent hemorrhage, when it is in the form of clots or brownish-red in color it indicates a stay in the stomach of medium duration, and when it is dark brown (coffee ground) the blood has been still more digested and changed by the gastric juice. In practice, it is seen in some quantity particularly in cases of ulcer, cancer, varicosities of the esophagus and stomach, and cirrhosis of the liver; and in streaks, in chronic gastritis, gastrectasia and injuries to the epigastrium. Other conditions in which it is observed are rupture of an aneurism into the esophagus or stomach, swollen states of the spleen, the swallowed blood from the head or lungs, passive congestions due to heart disease or obstructive disease of the portal system, toxic gastritis, in the severe anemias (cholemia, leukemia), hemophilia, vicarious menstruation. Hodgkin's disease, scurvy, purpura hemorrhagica; typhus, yellow, malarial or relapsing fevers; malignant small-pox, and others. Care must be taken to distinguish true hematemesis from blood delivered from the stomach which originally came from epistaxis, throat or mouth conditions, or that swallowed by malingerers and hysterical persons. It must be remembered that red wines, preserves made from berries, etc., may give the appearance of red blood, and that coffee-ground vomit may be simulated in appearance by coffee, cocoa, bile and iron or bismuth preparations, all of which may give a brownish or blackish coloration to the stomach contents.

Fecal vomiting is indicative of intestinal obstruction, fistulus gastro-intestinal communication, or severe peritonitis. Pus is present

in suppurative and infective gastritis, rupture of an abscess into the stomach from nearby structures, such as subphrenic, hepatic, or pancreatic abscess. Segments of tenia, ascarides, oxyuris vermicularis, ankylostomum duodenale, trichinæ, fragments of echinococcus cysts rupturing from the liver or spleen, are sometimes found in returns from the stomach, about which it may be said that they are all rare, and that tenia and ascaris are the more often seen.

Hiccough may be present in gastritis, gastrectasia, gastric cancer, neurotic conditions and in intestinal and other abdominal organ conditions. It is occasionally seen as a symptom in hysteria, shock and mental emotions, and in disease of the brain. In light forms it is of little consequence, but when it develops late in well established disease it is a symptom of grave prognostic importance.

Any distinct interference with the process of digestion either in the stomach or intestines may cause constipation or diarrhea; the first is by far the more common. In the neuroses of the sensory, psychic or mildly irritative types, the movements may remain normal. Constipation particularly is found present in the gastrectasias, supersecretion (hyperchlorhydria and gastrosuccorrhea), ptosis, esophageal and pyloric stenoses; in spastic, true obstructive or atonic states of the intestines, particularly the colon; for dietetic reasons, when abundant foods are partaken of which leave little residue (milk, eggs, meat); when too little fluids are taken, in heavy tea and red wine drinkers; where there is alteration or diminution in the digestive fluids (fever, polyuria in diabetes, etc.); in abnormal conditions of the rectum, anus, prostate, or uterus; and where constipation is found to be a constitutional trait.

Diarrhea on the other hand may ensue from constipation when the long presence of feces or that of other abnormal substances acts as an irritant to the mucosa, when increased irritability of the nervous system causes it to respond with unusual vigor to stimulation, and in a hyperemic or inflammatory condition of the mucosa causing increased secretion or transudation. It is seen in enteritis (catarrhal, croupous or ulcerative from whatever cause), in sudden psychic influences and hysteria; in intestinal crisis of movable kidney, locomotor ataxia, exophthalmic goiter, uremia, intestinal cancer, the marked anemias; from the ingestion of too abundant, indigestible or toxin-producing foods; from sudden changes in temperature and the tissue relaxation and increased activity of micro-organisms produced by prolonged hot and humid weather, sometimes in appendicitis, and as a symptom of profound exhaustion in tuberculosis, nephritis, Addison's disease, cancer, pernicious anemia, etc.

Details as to the character of the stools are of much importance. The shape of the stool at the time should be learned if possible. The stool of constant small caliber is found in cases of early cancer of the rectum and sigmoid, in prolapsus ani, occasionally as an early symptom in intussusception, and in incomplete states of cicatricial stenosis or spasm near the anus. The constantly flattened, or ribbon-shaped stool of normal consistency is observed in the same condition as above, to which may be added the presence of any growth that may press upon the gut interfering with the roundness of its lumen when distended; among such formations may be mentioned ischiorectal or prostatic abscess, large hemorrhoids, and prolapse of the uterus. Rounded masses of hardened feces (scybala) are characteristic of habitual constipation, especially when this is due to atony and dilatation of the colon. It is present in states of high acid-enzymotic secretion of the stomach, in gastric and gastro-enteric atony, and in the other conditions enumerated under constipation, to which may be added the use of opium, bismuth, and astringents.

The odor of the stool is also of value in the diagnostic way. A sour odor may be present in heavy milk drinkers when the bowels are moving rather freely. An unusually offensive one is found when for any reason there is an absence or deficiency of bile poured into the intestine; in acute enteritis, typhoid; occasionally in constipation, in syphilitic or carcinomatous ulceration of the rectum (in which cases the bowel movements are fluid from the ulceration), and where substances rich in sulphur have been taken, such as many eggs, compound licorice powder, and sublimed sulphur (in these instances the ill-smelling stools are due to sulphuretted hydrogen).

In obtaining information of the color of the stools the matter of appearances which certain foods or medicants give to them should always be taken into consideration. Light yellow stools are common in excessive milk drinking, and deep red fruits and red wines may darken them considerably. Rhubarb gives a light brown color to stools, and bismuth a bluish green. A constantly clay or light colored stool is usually significant of deficient bile secretion into the intestine. This condition is seen in gall-stones interfering with the flow of the bile, catarrhal states occluding the ductus communis choledochus, a tumor or displaced kidney pressing upon the common duct, or where there is deficient bile formation such as may be seen in anemia, chronic lead or phosphorus poisoning, gout, cancer, cirrhosis, amyloid disease or acute yellow atrophy of the liver. Green stools are seen where there is an activity of chromogenic bacteria in the intestine, when calomel had been given, or when, for any reason, there

is an increased peristalsis hastening the exit of bowel contents before the cholechrome has the brown color seen normally in feces which had collected in the lower bowel (this so-called "bilious stool" is sometimes seen in acute enteritis and for the same sthenic reason in chronic diarrhea). Black stools are present in extreme constipation, and when iron, manganese or bismuth had been taken. The "tarry" or red stool is strongly suggestive of hemorrhage. In this, depending upon the source, the amount of bleeding and the length of time the blood is in the intestines, the color varies. When it comes from the stomach or small intestine it is black or brownish black in appearance from alteration by the action of the digestive fluids. Hemorrhage, nevertheless, may occur high in the digestive tract, and when in considerable amounts and under conditions of increased peristalsis be delivered from the body quite red. The general rule, however, is that such high bleeding causes dark stools in which the blood is incorporated with the feces. When the hemorrhage is from a low source (colon or rectum) it is bright red in color and present only on the surface of the dejecta, or may be passed without feces.

Tarry stools are indicative of ulcer or cancer in the stomach or small intestine, or ruptured varicose veins in the esophagus. Such ulcers may be the round acute gastric or duodenal ulcer (or both together), or the multiple ulcer of the small intestine of the typhoidal, dysenteric, or syphilitic types. Other conditions in which such stools are seen are when blood had been swallowed from the lungs or nose, in thrombosis or aneurism of the aorta or superior mesenteric artery, engorgement of the portal circulation due to cancer, cirrhosis of the liver, portal thrombosis, valvular disease of the heart, emphysema of the lungs, in jaundice from any cause, in infectious disease, and in blood conditions such as hemophilia, purpura hemorrhagica, scurvy and leukemia. Again, it may be caused by tubercular ulcerations in the intestines due to phthisis, as a result of injuries to the abdomen, and finally the presence of intestinal parasites may cause it.

Bloody stools, on the other hand, may be caused by any of the above conditions when blood is delivered unaltered into the lower bowel; from hemorrhoids, cancer, ulcer and polypus of the lower bowel, fissures of the anus, amyloid disease of the intestine, acute sigmoiditis and colitis, sudden diarrheas of exophthalmic goitre and, in children and infants, intussusception.

Most of the intelligent and observing patients will readily answer the question or will voluntarily supply the information as to the presence of increased amounts of mucus that may be passed with the feces, or that they have had passages consisting mostly of fluid

mucus. When mucus is voided in plainly macroscopic amounts it is pathological and indicative of some catarrhal process in the intestine. Where it occurs as a thick coating upon the feces, or if mostly mucus is passed with little or no feces, it designates an inflammation of the large intestine or rectum. When it is incorporated with the feces, the catarrhal process is usually in the small intestine. In the first instance, mucus is often passed in dense looking shreds resembling long folded strips of loose, white fibrous tissue, although closer examination or questioning will often disclose the additional voiding of the more fluid gelatinous mucus, resembling egg-white. In the ignorant or less observing patients, the passing of mucus may not be noticed until their attention has been drawn directly to it. Conditions in which quantities of mucus are passed rather chronically are the various combinations of abdominal ptosis, in colitis, sigmoiditis, and proctitis. In enteritis, enterocolitis, and dysentery, the mucus is of the incorporated variety and may not be recognizable to the naked eye. True membranous shreds (not mucus) may be observed in necrosis and sloughing of the intestinal mucous membrane, which condition may occur in cancer of the lower bowel and rectum, ulcerated and intense inflammations of the colon, sigmoid, or rectum, and relapsing fever. An oily, greasy looking, fatty stool may be noted in obstructive jaundice or where deficiency or no bile is being secreted. In these instances, the feces is whitish, gray, or light yellow in appearance. The darker stools of fatty diarrhea are suggestive of cancer of the pancreas, or impacted calculi in the pancreatic duct.

Among other objects that may be observed in the stool are intestinal parasites or segments from them; such as the round or pin worms, and the varieties of tenia. Gall-stones, enteroliths, polypi, and a sloughed segment of the bowel in intussusception may also be seen.

HISTORY RECORDS.

The virtues and advantages of keeping records of the cases examined, the treatment prescribed and results from same, are of inestimable value, and the busier the physician in the clinical way the more necessary it is that such details as may pertain to a case be noted in writing and not trusted to memory alone. Such records are not only of value for medical literary purposes, but by preserving records of cases that had been treated successfully in the past, valuable information from personal observations in the trite notes on the case are, in the history box, of much steady service as records for a wider scope of service in any new case that may be on hand. Added

to this, is the advantage of being able to quickly obtain from the files the record of a case treated years ago and which person again comes under observation, and the comparing of such latter record with that of the past.

It is surprising how little more time it takes to make records of cases when one habituates himself to it in steady practice. As the individual relates his history before you, as he responds to the questions that you ask, a pen or pencil noting terms in abbreviation can follow a history along with but trivial loss of time, and a record may be compiled which would be of much future value.

For the purpose of recording this, and referring to it subsequently, the use of history cards is the handiest. These may be kept in a box upon the office desk, in which the box cards are kept in alphabetical order according to the names of patients. The same may be said of cases seen in the hospital or sanitaria. In dispensary clinics, however, it has been my observation that when many cases are being handled, it is best to keep such cards in numerical order according to the number on the dispensary cards rather than according to the names of the individuals. My reasons for this are that it is quicker to note the number on the clinic card and find the proper card in the file, than to ask, get the response, and then sometimes have to analyze the name, particularly when it is a peculiar one, or poorly pronounced. Added to this, is the disadvantage in finding the card among a great number of others, all kept together in the divisions under the one letter. When the cards are in numerical order, index cards, separating each fifty or a hundred history cards, are further helpful to find one particular card quickly. My clinic history card is the same as the following, excepting that there is printed in the center of the top, to record the case number, No. ———.

After considerable experimenting, I have finally concluded upon a form of card which seems to be as perfect as it is possible for me to plan one. The card is somewhat larger than the average run of record cards, being 5 by 8 inches in size, and the arrangement of the printing on it is displayed on the following page.

The personal history is the line upon which I record the habits of the patients, their hygiene, and their use of alcohol, tea, coffee, and tobacco. The local history has to do with the subjective symptoms as detailed by the patient, and the objective symptoms the results of the physical examination. The back of the card is without printing, having merely ruled lines for record of treatment. Such cards are of service for all kinds of internal medical work.

It is important, of course, to have attached to the record the

Name Address Diagnosis

Date S. M. W. Children Occupation Age

History—Family

Personal

Local

Objective Sym.

Dr. Bassler's History Card.

Fig. 9.—Front of author's history card. The back of the card is plain with ruled lines for keeping record of treatment. Size 5 x 8 inches.

laboratory findings in the case. If this necessary printing was placed upon a history card of workable size, it would seriously curtail the amount of space for history and treatment record, and, unless a large sheet of paper were used (which would be less handy in the way of filing and finding), the record would not be complete. In practice, it will be found that it is not necessary in all of the cases that are seen to do very much laboratory work to make a diagnosis, and thus a laboratory record for each history record might be superfluous. On the other hand, are cases in which, for diagnostic and therapeutic reasons, one or more such laboratory records are essential to have. In these instances, to keep appending cards or sheets to the original one, upon which space is allotted for histories and treatment as well as reports from the laboratory, causes much of a confusing disadvantage and waste of expense in paper and printing. For these reasons, I use a separate laboratory record slip (on thinner paper than the card) which can easily be attached to the gross clinical history of the case.

It will be seen that such a laboratory slip would answer practical purposes for all kinds of internal work in hospitals or clinics where special gastro-enterological work is not carried out in the detailed way, as well as in all instances where detailed gastro-intestinal work is done. Such slips are supplied in padded form of fifty to the pad, and, with the cards, can be purchased at an inexpensive price.*

* Scherer Bros., Printers, No. 38 East Eighth Street, New York City.

TEST MEAL

Date No.
Simple or Mixed
Time Removed
Amount
Reaction { Congo Red, Litmus }
Free Hcl { Resorcin, Amido-Benzol, Phloroglucin }
Töpfer's { Free Hcl, Total Acidity, Combined Hcl, Total Hcl }
Lactic Ac. { Uffelmann, Kelling }
Ether
Pepsin Chymosin
Starch { Erythrodextrin, Achrodextrin, Maltose }
Motor Tests Gas Result
Bile Mucus
Blood Pus

Gross and Microscopical Findings

FECES

Date No.
Color
Consistency
Surface Ex. { Blood, Pus, Mucus, Bacteria, Tissue }
Food Particles

Bacteriological

Fermentation Gas Result
Gram—P. Gram—N.

Chemical Tests

Blood (Occult)
Putrefaction Gas Result
Reaction
H_2S Result
Indican Result

REMARKS

URINE

Date No.
Specific Gravity
Reaction
Appearance
Quantity, 24 hours
Indican
Bile
Blood
Pus
Acetone
Diacetic Acid

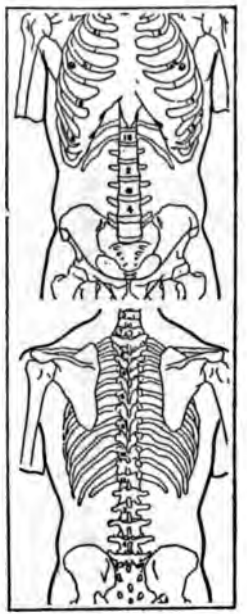
Quantitive

Urea
Albumin
Glucose
Ammonia, Total gms.

Microscopical

Mucus Blood
Pus Casts
Phosphates Urates
Calcium Oxalate Epithelia

REMARKS



BLOOD

Date No.
Hemoglobin (Dare)
Red Cells In a Cu. Mm.
Color Index

Erythrocytes
Size
Shape
Degeneration
Erythroblasts
White Cor. In a Cu. Mm.

Differential Count 1 — 1 { Polymorphonuclear %, Large Mononuclear %, Lymphocytes %, Mast Cells %, Eosinophiles %, Myelocytes % } Parasites.

SPUTUM

Tub. Bac. Influen. Pus Casts
Pneu. Coc. Pus. Organ. Blood Spirals
Fibers Crystals Parasites

Dr. Bassler's Laboratory Blank.

Fig. 10.—Author's laboratory record, to be attached to history card. Size 5 x 8 inches.

CHAPTER V.

Examination of Patients.

INSPECTION.

In a broad way, inspection of the body takes into consideration every external symptom any way concerned in the diagnosis of an internal disease. While a practical knowledge of the cutaneous diagnostic details are of much value in connection with internal medicine, and often have most important bearing upon the abdominal conditions, in this work the author will consider only those pertaining to the oral cavity, the abdomen as a whole, and the stomach in particular.

Among the essentials necessary for the inspection of a patient are a good light and a horizontal plane for the patient to lie upon, and in the selection of these, a few remarks may be made. After a rather close attention to the matter of light I have come to the conclusion that daylight has certain advantages and that artificial light thrown directly upon the patient has others, although of the two, in a general way, daylight is much to be preferred. The advantages of daylight are in the more perfect estimation of such details as color of the mucous membrane and skin and the better general illumination of the patient; and those of artificial light, in obtaining details in shadow effects and the concentration of a flood light upon a certain part of the abdomen while all about is dark. While these are matters of minor importance in a way, for fine work in physical diagnosis they may be very valuable in some cases. The best plan is to have an examining table near the window of a room so that the direct sunlight does not fall upon the patient, and another in a dark room above which table is a hooded chandelier throwing its light directly upon the trunk of the patient and a hooded portable light nearby capable of throwing a light, horizontal, transverse or vertical to the abdomen. By this arrangement of artificial light, often fine movements of the hollow viscera or slight eminences in the abdomen, which might escape observation in the daylight, are brought into more prominent relief.

In the selection of a table, I much prefer one solidly built of strong wood and made to order by a carpenter to any table or examining chair I know of sold extensively for the purpose. The table I

now use and which gives complete satisfaction for office work is built of dark stained oak and has the following dimensions. The top of the table is 6 feet long and 28 inches wide, and this is supported by four strong posts 30 inches from the floor. The top of this table is covered with a thin mattress made of black oilcloth, on which is placed a thick head cushion to make the patient comfortable while lying upon it. Such a table also answers admirably for mechanical or electrical treatments of the abdomen. In hospital work, it is best, when patients are well enough, to have the person placed upon the wheeled carriage used for transporting patients, and have them taken into a well-lighted room rather than examine them in the bed. The bed is usually too low, too broad, and the foot end is in the way. On

Fig. 11.—Examining table used by the author.

the wheeled carriage you can readily pass from side to side and turn the patient as may be desired according to the play of the light.

The examination of the mouth may suggest information of direct cause or predisposition to disease of the stomach. A pale color of the lips is often significant of anemia, and a slight blueness beginning cyanosis from cardiac disease. A trembling of the lips may be due to extreme nervousness, and a convulsive raising of the upper lip or a drawing down of the angles of the mouth that of severe abdominal pain. Herpes labialis is especially common in malaria, pneumonia, febrile disease, and acute coryza. Rhagades or the scars from them are suggestive of syphilis.

The odor of the breath may be of considerable value in diagnosis. A common cause of bad breath is some form of chronic gastritis, or habitual constipation. Local conditions in the mouth may be the cause of a most foul odor to the breath; among such are caries of teeth, glossitis, lacunar concretions in the tonsils, suppurative and

necrotic conditions of the jaw or gums, and the severe diseases of the lungs. A urinous odor is not uncommon in uremia, and a sweetish odor of beer or apples in diabetes mellitus.

The secretion of the saliva may be checked in gastric neuroses, fright, febrile states, chronic gastritis, nephritis, and diabetes particularly when polyuria is present. On the other hand, excessive secretion of saliva is seen in irritated conditions in the mouth, in the psychic neuroses and hysteria.

The gums show a characteristic paleness in anemia, and a blue line at the margin in chronic lead poisoning. The entire extent of the gums may be reddened in scurvy, and swollen and sore in constitutional disease, mercury poisoning, or in gastro-enteric affections. In my opinion, when local causes can be excluded, the condition of the gums is a valuable barometer of general states of the body.

The examination of the teeth should always be made. Note should be taken of their general condition, the number and alignment of the molars so that thorough chewing of foods is possible, and that artificial teeth, and the plates supporting such, set snugly and are not irritating to the gums or palate. If a soreness exists in the mouth, because of artificial teeth not fitting properly, patients are liable (because of the pain) not to chew their foods sufficiently. Persons who neglect the care of their teeth have much tartar upon them with marginal ulcerations of the gums, usually have increased amounts of micro-organisms in the mouth, and these being swallowed could cause irritative conditions of the stomach.

A close examination of the tongue may be of some service, although in diagnosing digestive diseases or differentiating between them, much reliance should not be placed upon the findings. Müller and Fuchs, have found (and my own observations somewhat coincide with theirs) that 62 per cent. of all healthy individuals in youth and middle life presented a coated tongue. There is no doubt that in the past too much reliance had been placed upon the condition of the tongue as being indicative of digestive diseases. It should never be forgotten that because of the position, function of the tongue, and the commonness of pathological conditions elsewhere in the mouth and throat, the tongue is most susceptible to change from the normal, even when the digestive tract and general state of body be normal. Leaving out of consideration such local conditions and habits of smoking, alcohol drinking, etc., as may affect it locally, of some practical value are the following: The tongue is pallid in anemia, may be bluish in cyanosis from cardiac disease, have pigmented spots in Addison's disease, or be tinted yellow in jaundice. It is usually

very tremulous in chronic alcoholism and in insanities, and ulcered in syphilis and the exanthemata. It is distinctly dry (typhoid tongue) in states of general adynamia and prostration, may be swollen in septic conditions, and shrunken in old age (senile glossal atrophy) or as a result of paralysis. A thin white coating is common in excessive milk drinking and many cases of long standing mild degree of simple chronic gastritis. A rather flabby, pasty looking tongue showing marginal indentations from the teeth is the rule, in long standing cases of chronic gastritis having much mucous secretion, and in subacute gastroduodenitis.

The soft palate, the tonsils, and pharynx should always be examined. My clinical experience has been that "dry throat" is a common complaint along with other true gastric symptoms. More or less pharyngitis is commonly seen in cases of digestive disturbance, but I have yet to see a *bona fide* case of gastric disturbance —even of the neurotic type—entirely relieved by the cure of the throat condition alone. I do believe, however, that rather steady belching of gases, or the regurgitation of small amounts of foods from the stomach, often does cause a pharyngeal catarrh which gives local symptoms of distress. But that any most evident gastric case is ever developed from a pharyngitis, or, as is stated above, is cured by simply the treatment of same I have my serious doubts. Excluding the nasal and tonsillar cases of secondary pharyngeal involvement and those possibly of a most plausible primary nature, a pharyngitis in a distinct gastric case should always be looked upon as a primary condition or as a result of the stomach disturbance. Laryngologists cannot cure a "gastric catarrh" by curing a pharyngitis.

Inspection of the abdomen may give no details of diagnostic value, and in other cases again most useful information may be gained. As a routine it should always be performed in the beginning of every physical examination, and notes should be made of the appearance of the cutaneous surface, nutrition of the walls, shape, size, bulging (if present whether local or general), excursion or retraction of the abdomen as a whole during respiration, and also whether peristaltic movements of the gastro-enteron are visible.

The appearance of the skin of the abdomen in this connection is of value in the following ways: Linear albicantes are found following pregnancy or marked reduction in weight, both of which conditions may predispose to ptosed states of the movable abdominal organs. A line of pigment in the median line (particularly below the umbilicus) is indicative of pregnancy, a condition in which gastric distress and vomiting are common. Spots of eruption of the cutaneous diseases,

and the rose spots of early typhoid may be seen. Some knowledge of the gross appearances of the common forms of skin diseases is of value, particularly in being able to differentiate the irritative rashes due to toxic absorption from the colon and the excretion of these poisons by way of the skin, from the more chronic types of skin disorders. The yellow tint of jaundice or leukemia, or the fainter yellow of toxemic jaundice, or the very light brown of malignant cachexia may be observed. A general brown or brownish-black color is seen in Addison's disease, although here the pigmentation may be very faint and only present on the upper extremities.

General enlargement of the superficial abdominal veins may be seen in greatly dilated stomachs, cirrhosis or tumor of the liver, and obstructions of the vena cava. The so-called caput medusæ may be seen in obstruction of the portal circulation or hepatic cirrhosis. Note should be made of absent or limited abdominal respiratory movement (peritonitis), and excessive abdominal breathing (diseases of the lungs).

To note the nutrition of the wall is of much value in diagnosing gastro-intestinal cases. In malignant disease the subcutaneous fat of the abdomen is more or less lost. Likewise is this true in atrophic states of the glandularis of the gastro-enteron, marked gastric atony, and in the chronic constitutional affections. The skin will then be loose and wrinkled and may even sag at the flanks or gluteal region. In the neurotic, acute and most of the chronic catarrhal conditions this will not be observed.

The shape, size, and bulging of the abdomen often give important diagnostic suggestions. An abdomen that is large in size, pendulous in the upright position and which flattens in the recumbent position, means relaxed abdominal walls (a common result following pregnancy), and is often seen in the case of more or less splanchnoptosia and chronic colitis. Note should be made of the shape and breadth of the body, for the long thorax-abdomen type of individual often has a gastroptosis; the same may be said of those individuals who have widely flaring ilia and a wide costal arch. Under favorable conditions in thin-walled subjects, the outline of the stomach or colon may be seen, but only when these are much distended with gas. In such relaxed and thin-walled subjects the stomach may perceptibly raise the gastric region, or more or less coils of the small intestine may cause a general irregularity of the surface. Furthermore, the abdominal wall may be raised and present a local bulging from the mass of a neoplasm connected with any of the more deeply seated abdominal organs, even the kidneys.

The opportunity is frequently offered to observe the peristaltic waves of the stomach and the vermicular movements of the intestines. They present themselves as a series of rolling, rounding elevations, which increase and subside. In the stomach they usually run from left to right (antiperistaltic stomach waves from stenosis run from right to left but are never as prominent as the foregoing), and in the colon they pass from right to left. This may serve to distinguish in which organ they are seen, although those of the stomach are always sharply confined to the gastric region, while those of the small intestine and colon are more general in the abdomen. They can often be made more active by stimulation applied to the abdomen. For this purpose my preference is in sharply flicking the skin with the finger, although ether spraying, faradism, or striking with a cold wet towel may be employed. While visible peristalsis may occur in the normal individual, its principal diagnostic association is in connection with pyloric or intestinal stenosis and in the instances of the so-called peristaltic restlessness of Kussmaul, which is a neurotic disturbance of motility with or without subjective symptoms. In cases of obstruction it is a most valuable symptom, and in the benign conditions where the constitutional signs of malignancy are absent (cicatricial contraction, perigastric and perienteric adhesions, the pressure of other organs or growths from them upon the digestive canal, etc.), they are a sheet anchor diagnostic point. At times some practical inference may be drawn as to the site of the obstruction by the location of these movements and the behavior of bulging under pressure. If the obstruction is in the region of the ileocecal valve, the coils of the small intestine may lie one above the other in the center of the abdomen. If the stenosis is in the lower colon or high in the rectum, the distention is around the confined limits of the abdomen corresponding to the location of the colon. Should the distention and peristaltic movements be confined to the upper and left quadrant and running toward the pylorus the stenosis is at that region. Should a large globular distention exist which on pressure subsides with a gurgle of gas, and after which this distention recurs, and one has repeatedly the same experience with it, the stenosis is just below the dilated intestine pressed upon.

PALPATION OF THE STOMACH AND ABDOMEN.

The art of successful palpation is a very important one for every physician to acquire, and points of technique in doing this successfully are of much value. As the finger in a wound is the best kind of a probe—because the mind is directly connected with it—therefore one should think while palpating, rather than doing this in an aimless search for some surprise.

With the patient in the dorsal position and the entire abdomen from the thorax to the symphysis pubis exposed, the warm hand is laid gently and flatly upon the abdomen, where it is permitted to

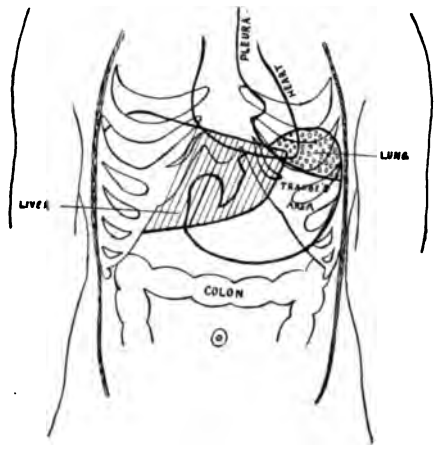


Fig. 12.—Showing the relation and coverings of the stomach in front to the liver, heart, left lung, pleura and left thorax.

remain for some moments until the patient is accustomed to its presence. The palpation is made with a circular pressing movement, sliding smoothly over the skin from one part of the abdomen to another. A steady gentle pressure is much to be preferred to any sudden poking movements. In the course of time, a rather firm pressure with the palmar surface of the tips of the fingers may be made to feel deep into the abdomen. The examination should be made with the knees raised and separated and the shoulders elevated so as to relax the abdominal muscles, advice is given to breathe deeply, and a detracting conversation often keeps the attention of a neurotic, apprehensive, or hysterical patient away from what is taking place and further favors relaxation of the muscles. During the examination, the physician's attention should be directed to the face of the patient making note of the facial expression as certain areas of the abdomen

are pressed upon. If sufficient abdominal relaxation cannot be obtained, examination in a prolonged hot bath, or under an anesthetic may be advisable.

The alimentary canal should be empty at the time of the examination, although the first visit may be taken advantage of for noting the presence of plainly evident physical signs, and also the presence of scybalous masses in the colon (constipation). If much gas is present in the stomach it is necessary to remove this by means of a stomach tube, or if the intestines are likewisely distended by irrigation or purgation. In a few instances the examination may be made on a stomach distended with food (peristaltic and vermicular movements, peristaltic restlessness and gastric stiffening). If it is desirous to press deeply into the abdomen one hand may be placed upon the other, and at each expiration the under hand is sunken, maintaining this position until the next expiration, when it is sunk deeper, and so on until further pressure is inadvisable. Since patients may evince a sense of pain when the nails of the examining fingers are dug into the skin, it is best to keep them trimmed closely so that the tactile pulp of the fingers projects beyond the nail edges.

The various areas of the abdomen should be systematically explored beginning first with the location of the stomach, then the small intestine, the ileocecal valve, all of the colon and finishing with the marginal or deep organs, such as the liver, gall-bladder, spleen, kidneys, etc. In examining the lateral portions of the abdomen both hands should be employed, the under one sustaining the lumbar region while the upper makes pressure upon it to note the character and consistency of the intervening tissues.

It is often advisable to change the position of the body from the dorsal, and is always essential to also examine prolapsed organs in the upright position so as to note their degree of descent. In the Deiho method for noting the position of the greater curvature the latter position is required so that the water sinks to the lowest portion of the organ. The spleen (when not much enlarged), and movable kidneys (when not very loose), may become palpable in the slightly forward sitting or the knee-chest position when they are not so in the dorsal. This position is also necessary to observe the true shape of the abdomen when standing (Landau's ptosis). A method of palpating for a movable kidney which I have found of much service (in fact I think it to be the best method) is, while the patient is sitting, to grasp during deep inspiration the side wall of the abdomen between the thumb in front close under the ribs, and the other four fingers of the same hand on the lumbar region. Maintaining this hold firmly,

the patient is slowly put in the dorsal position while the other hand, pressing deeply upon the abdomen below the thumb, delivers under it the intervening structures. Often in this way, a movable kidney will be felt to slip upward with a jerk, while at the same time the patient experiences the unpleasant sensation of when a kidney is directly pressed upon. In patients who have large fat abdomens it may be desirable to have them turn partly to the side (so as to displace as much of the abdomen and intestines as possible) while palpation is being carried on in the upturned side. The lateral position is also to be preferred to the dorsal in palpating the spleen or growths at the fundus.

A method to be recommended in all abdominal tumors is bimanual palpation. In this, with one hand on each side of the mass, better note can be made of its size, shape, surface, and movability; particularly is this valuable with small sized movable growths of the pylorus, pedunculated growths, and freely movable kidneys.

Palpation of the abdomen in women should always include the pelvic region, and a vaginal examination when organic disease or growths in the internal generative organs are suspected. Also, it is essential in both men and women when the least suspicion of rectal disease exists to examine the anus, rectum, and possibly the sigmoid.

It is now important to consider in some detail, findings which are away from the normal. The diagnostic points between cancer and false tumors; those of involvement of the different abdominal organs will be found in Chapter XXI.

Pains, Direct and Reflex, and Pressure Distress.—The most common symptoms obtained by palpation are hypersensitiveness or pain on pressure, and these comprise most valuable factors in the diagnosis of gastric conditions. Before beginning a consideration of these, it would be well to state that deep pressure upon the epigastrium in perfectly normal individuals is often accompanied with a feeling of distress and sometimes nausea. On the other hand, normal persons are seen in whom this does not exist, and I have observed the same to be true in a number of the gastric neuroses cases where these are psychic in origin or of a secondary nature. It is logical to assume that any sensitiveness to rather light pressure—which when further continued causes actual pain, not simply nausea—is caused by some local condition in the stomach or in the organs immediately about, and it might further be said that most persons who come under observation distinctly as digestive cases, in which some degree of discomfort is not caused by deep pressure below the ensiform, are either a gastric neurosis or the cause of the gastric symptoms must be searched for

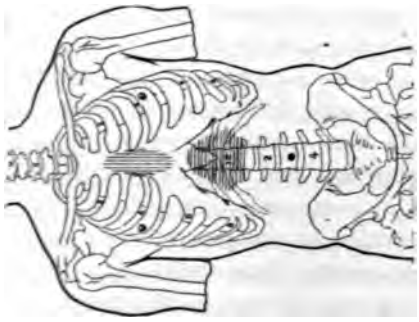


Fig 1

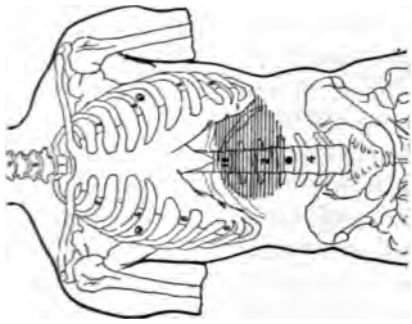


Fig 2

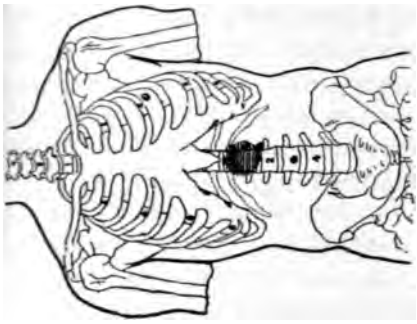


Fig 3

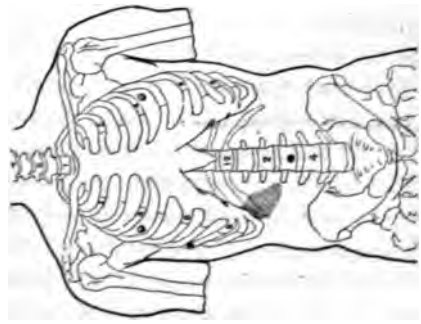


Fig 4

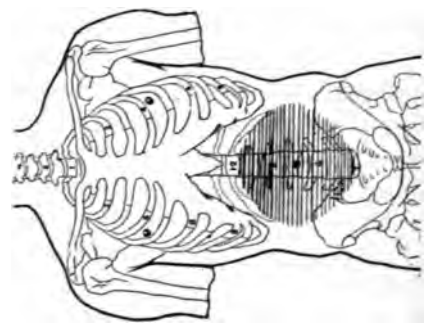


Fig 5

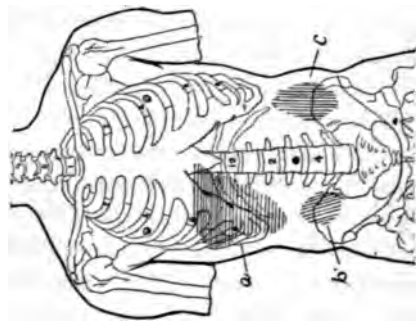


Fig 6

Fig. 13.—Front areas of pain or tenderness.

Fig. 1.—Painful and tender areas on pressure in neuroses, gastroptosis and gastrectasia.

Fig. 2.—Area in which are usually found the pains or distress on pressure in gastritis, erosions, impacted gastric colon and the pains of carcinoma ventriculi.

Fig. 3.—Sharply localized pain area of gastric and duodenal ulcer.

Fig. 4.—Area of pain in cholelithiasis, gall-bladder disease and disease of the bile ducts.

Fig. 5.—Area in which are found the pains of enteritis, enteralgia, colics, intestinal obstruction, peritonitis, embolism of the mesenteric artery, floating kidney, aneurism of abdominal aorta and disease of the pancreas.

Fig. 6.—Pain locations in disease of the liver and impacted hepatic colon: at *a*, appendicitis; at *b*, renal colic (either side), mucous colic (usually left), constipation, stercoral ulcer and sigmoiditis, etc.

elsewhere. Again, it must be added that sensitiveness to pressure in the epigastrium might be caused by disease of the left lobe of the liver, colon, and pancreas, as well as by true stomach conditions. So too, a sensitiveness over what may be considered as the greater curvature of the stomach may be due to disease of the transverse colon, small intestine, or omentum. Of much confirmatory value that the pressure on a certain area of the abdomen is causing actual pain, or that a *bona fide* organic disturbance of the viscera below exists, is a constantly present resistance of a section of the abdominal wall at the same point, while in other regions the wall remains lax when pressed upon; such is often seen in conditions of the pylorus, gall-bladder, and appendix. Together with the above will be considered swelling and tumors, and succussion or splashing sounds.

Tenderness, more or less general, is common in acute gastritis and somewhat less so in chronic gastritis. It is found in some of the sensory neuroses, in diffuse gastric cancer, in gastroptosis, and in gastric ulcer. In the catarrhal conditions it is usually diffuse over the gastric region, and, excepting in the very acute conditions, is not accompanied with much if any resistance. In the local neurotic and gastroptosic cases the tenderness is usually confined in an area just below the ensiform about the size of the palm of the hand, and as a rule is not accompanied with resistance. The front pains of gastric and duodenal ulcer are sharply localized, situated just below the ensiform to the right or left of the median line, and generally are accompanied by a quickly responding and stern resistance; the same may be said of unfavorable post-ulcer conditions, although in these (because of less pain) the resistance is liable to be not so prominent a feature as in acute ulcer. Occasionally in ulcer of the duodenum the small area of pain is at the right of the median line, while that of ulcer of the stomach is to the left. This is a point that deserves mention but should not be emphasized too strongly since many gastric ulcers manifest a tender and painful spot to the right of the linea alba.

Diffuse pain is also observed in perigastritis, in perforating adhesions of the stomach with the neighboring organs, and finally rupture of an ulcer into one of the peritoneal cavities particularly the lesser. Localized pain is also observed in traumatism, localized peritonitis, and perigastritis, phlegmon of the stomach, disturbed conditions of the celiac or solar plexus of the sympathetic and the celiac axis. Multiple circumscribed spots of tenderness over the stomach and elsewhere in the abdomen are strongly suspicious of a nervous dyspepsia or neurasthenia.

In the matter of different locations in the abdomen upon which

pressure elicits pain the following may be included. Those of gall-bladder or gall-duct disease are manifested rather locally over these structures. An inverted elongated triangle with its base corresponding to the costal margin at the tip of the ninth costal cartilage and the apex at the navel would include them. It must be remembered, however, that deep palpation over the ducts would also closely include pressure upon the pylorus and the pyloric region of the stomach, the duodenum, and the transverse colon at that point. The symptoms and the clinical course of the case together with the rather distinctive back pains of gall-bladder disease would serve to differentiate them. The pains of disease of the liver, obstructed portal circulation and hepatic colon are more diffusely spread over a larger area corresponding to the liver itself. Those of enteritis, enteralgia, colics, intestinal obstruction, peritonitis, embolism of the mesenteric artery, aneurism of the abdominal aorta, disease of the pancreas, and floating kidney are usually in the center of the abdomen. In appendicitis, and those due to inflammation in the ileocecal region the pains are low on the right side; while those due to constipation, stercoral ulcer, sigmoiditis, mucous colic, etc., are low on the left.

Tumors in the Epigastrium, etc.—In examining new growths of the stomach it should be remembered that many different forms of tumors are met with but that in elderly persons most of these are cancerous formations either at the pylorus or lesser curvature (combined about 78 per cent.). These are usually felt as situated a little to the right of the median line between the ensiform and the umbilicus. The growth may be quite movable and capable of displacement, or if adhesions to fixed organs or tissues are present it is firmly moored. If these adhesions are with the liver (one-fourth of all cases), or with the diaphragm, the growth may move with respiration. A deep-seated, small-sized palpable mass may be felt in cases of chronic gastric ulcer and ulcus carcinomatosum, and, under favorable conditions, the pylorus in hypertrophic gastritis and the diffuse thickening of a perigastritis may also be observed. The palpation of a tumor depends more upon the rigidity and thickness of the abdominal wall, the position of the stomach, and the position of the tumor in relation to neighboring organs than it does upon the size of the tumor. On this account, tumors are more commonly palpable in women, in whom the abdominal organs are more frequently ptosed and the belly wall relaxed than in men. A table of differentiation between true and false gastric tumors will be found in Chapter XXI.

If the abdominal walls be thin and relaxed and the stomach empty it may be possible to feel growths of the pancreas, and, as Ewald has

shown, even the normal gland and lymphatic glands in the gastro-colic ligament. In cases of cholelithiasis a mass corresponding to the site of the gall-bladder, moving with respiration, is not uncommonly palpated. New growths connected with organs elsewhere in the abdomen may be felt in other localities than the upper zones. Among these in this connection should be mentioned floating kidney and fecal tumors both of which may be found above or in the transverse umbilical line. Unless bound down by adhesions, displaced kidneys are freely mobile, and masses due to the presence of scybala are migratory along the colon and are usually moved onward by a brisk cathartic, a practice always to be advised when any doubt exists as to the character of a mass felt anywhere in the abdomen. Lastly, it should be mentioned that results from palpation in the way of noting the contracting power of the abdominal walls and the voluntary control over them are very valuable in diagnosing relaxed and atonic states of the muscle walls; often observed deficient in ptosed states of the organs within.

According to Head, stimulation is excited from diseased states of internal organs, and, being transmitted by way of the sympathetics to a distinct spinal segment, are referred to sensory fibers of the skin which pass backward into the same segment. This means the existence of hyperalgesic areas on the body reflexly caused by disease of organs within, and according to the localities in the skin in which these areas are observed, inference of diagnostic worth might be made as to which of the internal organs are affected. After a rather close attention to the existence of these so-called Head zones in cases which at operation or autopsy were found to have been properly diagnosed, I must state that but little dependence can be placed upon them in any diagnostic way. They are frequently found in disease of the viscera, but are by no means constant. No conclusions, therefore, can be drawn from their absence, and in my experience errors in diagnosis are enhanced because when apparently present they are liable to be found in zones not corresponding to the organs involved. The attempt at localization of lesions by means of the situation of the zones is impractical. When considered in connection with other symptoms the phenomenon may have a slight value, but this is very limited, and too many impossible to accurately distinguish other causes may give these sensitive areas and thus lead to the error of supposing that internal disease exists; such as where the spots are due to hysteria, uremia, neuralgia and central neurological affections, etc. Again, it requires the greatest care and patience on the part of the physician to make these observations, and, more significant

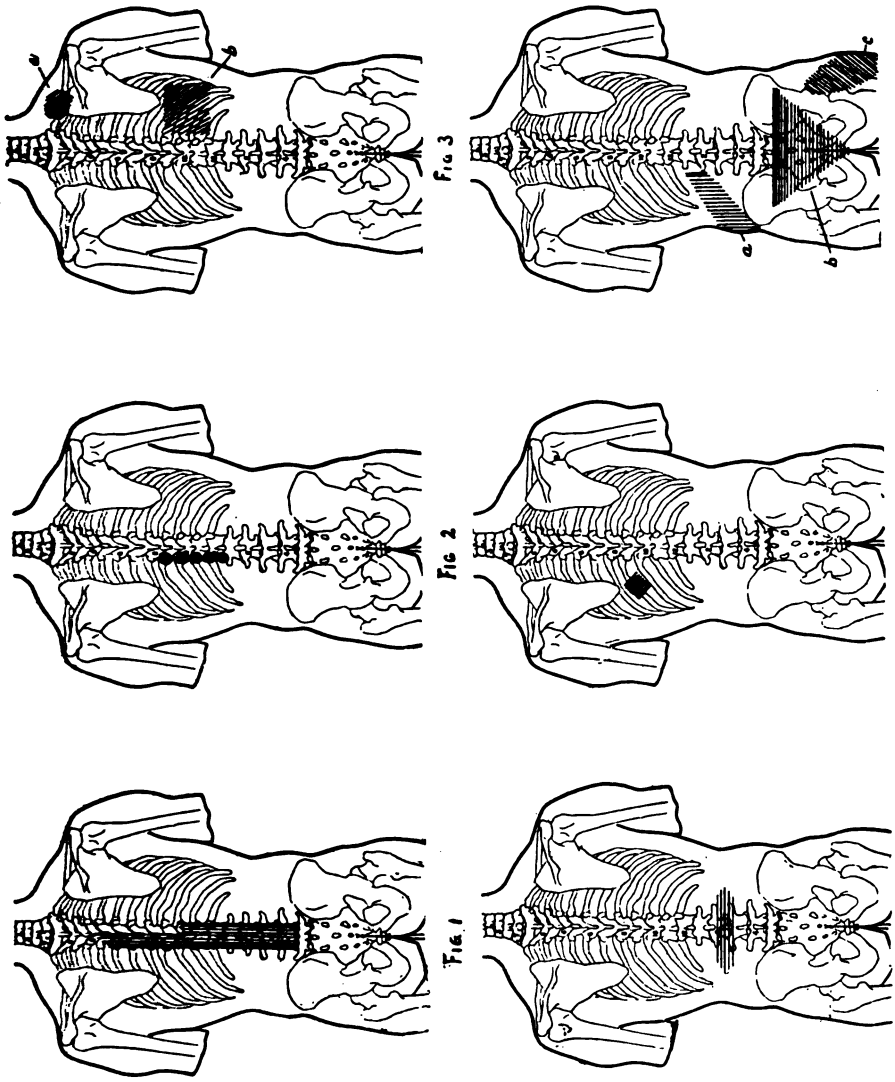


Fig. 14.—Back areas of pain or tenderness.

Fig. 1.—Area in which the painful zones are most commonly met with in gastric neuroses.

Fig. 2.—Sharply localized areas in which the back pains of acute gastric ulcer are generally found.

Fig. 3.—Area in which the pains of cholelithiasis are usually found: *b* is the common; this area may be found farther up in the scapula region; *a* represents another point to which the pain in this condition may be referred.

Fig. 4.—Aching pain zones due to a loaded colon, constipation, colitis, lumbago, debility, and abdominal aneurism.

Fig. 5.—Site of pain in disease of the spleen.

Fig. 6.—*a*, pain area of renal colic, perirenal abscess and neuralgia; *b*, diseases of the generative organs, ulcer or cancer of the rectum, disease of the sacro-iliac joint, hemorrhoids, sacral neuralgia and coccygodynia; *c*, pelvic disease.

still, the patient must be of the intelligent kind. Even with a desirable patient for the examination, the gentle pinching, rubbing or scratching of the skin with a dull instrument, an apparently positive result at one moment cannot be confirmed as present in the next. My experience has been that the pyloric and gall-bladder zones are more often present than most of the others, but that much attention in the diagnostic way should not be attached to their absence.

Important to note are painful areas to point-pressure on the back, on the abdomen, and thorax. Most of the conditions giving such indirect pains are shown in the above illustration. Some of these are not elicited or intensified by pressure upon the skin, and are entirely subjective; others, again, are first found existing during the examination and are markedly increased on pressure.

The gastric conditions particularly in which pressure-points or areas are found are gastric ulcer and the neuroses. In gastric ulcer, as Boas[1] has shown, in about one-third of the cases pressure-points are present situated to the left of the spine close to the body of the twelfth dorsal vertebra. In my experience, the tender area found in cases is often higher than this, and from the eighth dorsal to the first lumbar may be considered as the limits in which this back pain is observed. When present, it is noted as a very tender area close to the spinous process and is most exquisitely painful to deep point-pressure. On the other hand, cases are seen where the characteristic tender area is to the right of the spine, and these are more suggestive of the ulcer being present close to or at the pylorus or in the duodenum. Kelling[2] considers this pressure-point as due to the supersensitive posterior branch of the intercostal nerves, due to a reflex hyperesthesia from the sympathetic nerves. Care must be taken that the commonly present tender spinal areas (also found close to the spinous process but usually higher up) which are due to neurasthenia, disease of the spine or cord, infectious disease, and so on, are not mistaken for those due to ulcer. Any area in the back, which more diffusely covers a larger area over, at only one, or at both sides of the spine, is more liable to be due to the gastric neuroses. Such areas are usually to the left of the spine, or in the infrascapular region. They are not so tender to pressure as the point areas of ulcer, and may be found shifting to different localities as the case improves under treatment. Occasionally, in gastric cancer the presence of a subjective back pain is described. Usually, the location in which it is found is in a transverse area about at a level with the twelfth dorsal vertebra. In these cases pressure upon this area rarely causes any distress.

In gall-bladder and liver disease, a painful area is commonly pres-

ent in the back on the right side. It is usually diffuse, although in uncomplicated gall-stone disease it may be quite localized somewhere to the right of the eleventh dorsal vertebra and along the course of the last ribs. Also, in cholelithiasis a reflex area of pain may be present in the back of the right shoulder at the upper part of the scapula. In disease of the intestines, and particularly in loaded colon, coloptosis, and chronic colitis, a subjective transverse pain directly in the small of the back is commonly complained of. In enlargements of the spleen (malaria, leukemia) the dragging weight of the organ or the rapid overstretching of its fibro-elastic framework may cause a point pain midway between the spine and the thorax margin about at the eighth rib. Other locations in the back (with their causative conditions) in which pain is present are shown in Fig. 6 of the foregoing plate.

Palpation of the abdomen in the way of noting sounds in the stomach or colon which are caused by tapping strokes of the finger tips are of value in diagnosis. It must be remembered that any splash sound obtained over the stomach or colon does not necessarily mean atony or stagnation in the stomach or likewisely disturbed states of the colon. With fluid and gas present in either viscus, even a loud splash may be obtained in a perfectly normal individual. Gas is normally present in the stomach during gastric digestion (chyme is fluid), and the intestinal contents are fluid in the ascending and often in the transverse colon where gas is also present. Leaving out of consideration the sounds produced in the colon, it must be said that there is some value in the diagnostic way to splash sounds in the stomach. They are commonly found in cases of gastric atony when the stomach lacks in power to hold firmly to the gastric contents. In these conditions, because of the interference with the dynamic power of the stomach to expel its contents into the duodenum and perhaps because of an existing neurotic disturbance with this, an increased fermentation takes place and the conditions favorable to produce the splash or succussion sounds are then present. Likewise, in cases of pyloric stenosis from any cause, the late presence of stomach contents fermenting into gases long after meals, the symptom may be of value in a few cases as confirmatory of stagnation—particularly when this is found in the morning before partaking of food and drink, although here it may also be due to gastrosuccorrhea of a high degree.

Of much more importance than its presence in diagnosis is to note the limits of the stomach area in which these sounds can be produced, and the position of the lower border of the stomach can often be made out by taking advantage of these sounds. To do this, it is

advisable to approach the stomach area from below the navel in the median, then in the nipple, and also on a line between the two. Beginning over the intestines as you would, by a series of short, quick, gentle, downward strokes with a finger tip, and going up toward the stomach, a point is noted where with the same degree of force and depth of stroke the splash sounds are observed. A mark on the abdomen should there be made, and the performance repeated so as to obtain the accurate point. The gentler the stroke the surer you will be of the position of the greater curvature, for when a heavy stroke is employed much of the deep tissues beyond the finger are agitated and a splash in the stomach may be obtained when the fingers are some distance below the greater curvature. Sometimes (in ptosis) this splash will be noted over the pyloric region until the lesser curvature is reached when it is again lost, although percussion should then be employed to observe whether the reason of this is due to the interposition of the left lobe of the liver, or whether the fingers are beyond the stomach proper—the liver being high in place. It is best to use only one finger in these examinations, and have the abdomen relaxed by flexion and separation of the lower extremities and raising of the shoulders.

PERCUSSION OF THE STOMACH AND ABDOMEN.

In the prescribed percussion of the organs in the abdomen the distinctions to be made are between different degrees of dullness and tympanicity. With the exception of the area over the liver and spleen, the abdomen is normally tympanitic with a pitch of resonant note varying in different patients according to the size of the hollow organs and the degree of distention within them. The stomach and colon under normal conditions give a lower pitched note than the small intestine; under marked distention, however, they may give a much higher resonance.

General distention of the abdomen as a whole is observed where there is much fat in the abdominal walls, when there is an excessive amount of gas in the stomach, intestines, or free in the peritoneal cavity, or when a large tumor is present in the abdomen.

When much abdominal fat is present, results from physical examination in the way of noting the presence of small sized growths, etc., are always doubtful. An accumulation of fat in the mesentery may simulate a median tumor or possibly a pregnancy in very adipose subjects. If the distention is due to ascites, in the dorsal position the fluid gravitates to the rear of the abdomen floating the intestines above it—therefore the flatness and bulging of the flanks, and the

increased tympanicity in the center of the abdomen. If the latter patients are then placed upon the side, the uppermost dull flank of before then becomes tympanitic. In the rare cases of large sized abdominal tumors the center of the abdomen is dull while the flanks are tympanitic from the displaced hollow viscera. If the distention is due to gas in the intestines the entire abdomen is generally distended and tympanitic; but the liver and splenic dullness is usually preserved —a point of much diagnostic worth in decreeing whether the gas is confined to the gut or is free in the general peritoneal cavity (peritonitis).

In percussion of the stomach it must be recollected that, as compared to the chest, the technique must of necessity be much finer in detail. In the chest we deal with very resonant lungs and dull heart, and the comparison between the two is always marked. But in the stomach we deal with an organ of which more than one-half is covered by the thorax, and most of the pyloric extremity and all of the lesser curvature are deeply seated and covered by the liver. Then again, all degrees and characters of distention are encountered from the full stomach dull from food or drink, and likewisely dull when empty, to those in which a height of tympany exists from distention with accumulated gases. These facts must all be taken into consideration in the percussion of this organ, and therefore it is essential to be cognizant of what and how much in the way of ingested substances may be present in the stomach at the time of examination.

The best results are always obtained by examination in the prone position with the lower extremities extended or only slightly raised. Occasionally, in a very slim subject with fluid in the stomach, it may be desired to note by percussion or palpation how low in the erect position the lower border of the stomach descends. In regard to this it may be said that any results possible to be obtained from examination in the erect position are usually somewhat questionable and are but poor substitutes to X-ray observations with bismuth in the organ. My experience in diagnosing ptosed and dilated states of the stomach, the comparison between where the tympanic note of the upper border in the two positions is situated is of more value than in examining for the position of the greater curvature—in the upright position the proximity of the transverse colon to the lower border of the stomach is often most confusing. It is of more value than the last mentioned position to examine a patient when lying on the left side, because then most of the stomach fluids pass toward the fundic end and the pyloric extremity comes somewhat forward and thus is more accessible.

Technique of Percussion.—Much has been written upon the technique of percussion and the desirable ways in which this should be performed. Because of the great value of this measure of physical examination in stomach work the author will relate in some detail his own experiences. The most complete results are obtained by a combination of finger percussion finished with the use of a pleximeter.

In finger percussion the applied finger should be pressed quite firmly, evenly, and transversely to the abdomen, and slid over the skin

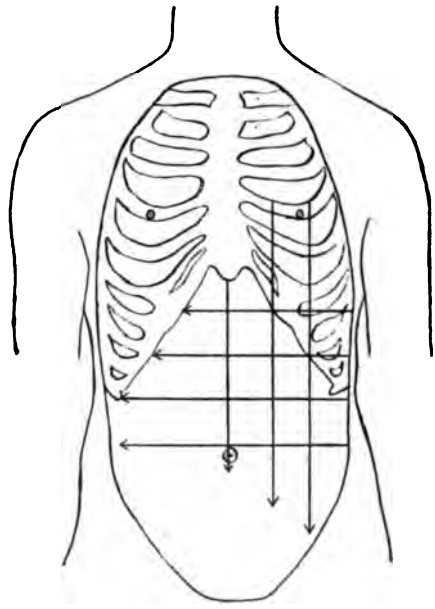


Fig. 15.—Showing the routes of systematic percussion of the stomach for the purpose of mapping out its size, position, and the location of growths.

without taking it from it. The percussion movement should be from the wrist with the fingers held stiffly. The tip of one finger should be used as the plexor, and it should strike the pleximeter finger perpendicularly. The strokes should be equal in comparison and not too frequently delivered, after which the striking finger should immediately be removed. The stroke should always be light in force, because if it is heavy a confusing resonance from all of the organs in the vicinity is obtained. The sound produced should be just loud enough for the examiner to hear with his head bent rather low over the abdomen.

In the percussion of the stomach the limits of the normal stomach should be kept in mind, the thorax and liver covering above and the close proximity to the transverse colon below. Practically, the normal stomach tympany begins at the site of the apex of the heart, about at the fourth intercostal space in the axillary region, extending below this into the abdomen so that its greater curvature extends from about the ninth costal cartilage, across the abdomen above the umbilicus to the right of the median line. The comparison of resonance between the dullness of the liver and the tympany of the stomach should be close and decisive.

Whether one begins by percussing the stomach from below or above is of no significance providing the entire stomach area is examined in some routine way, and for this purpose it is wise to habituate one's self in following certain fixed lines in each instance. Though it has been my custom to employ, and which serve the purpose

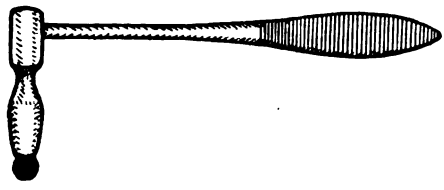


Fig. 16.—Vest pocket rubber-tipped pleximeter used by the author.

amply, those depicted in Fig. 15. As the margins of the stomach are outlined, the borders should be marked on the skin with a blue pencil. In this way the sagging and low hanging stomach of gastroptosis and the large stomach of dilatation can be diagnosed and accurately recorded in position, shape, and size. To these ends, the percussing hammer is of some value particularly when the stomach has not been artificially inflated. It has been a regular experience with me that by its use somewhat finer work in accurately outlining the stomach borders is possible than with the fingers alone. While not recommending the use of a pleximeter in diagnosis for all percussion work—the hand method is to be preferred because it gives a lower note and the sense of resistance under the hand is more accurately appreciated—still, in this single instance it has served me well and I believe is worthy of use. In the very softest kind of percussion work, the stroke from the hammer can be more accurately gauged (so as to produce a slight blow) than that of the striking finger, and one can be surer that the blow is delivered perpendicularly.

As a rule, ordinary percussion of the stomach is not trustworthy.

Anteriorly, the surrounding structures, and the fluid and food substances in the organ interfere with obtaining definite results, and the covering of the left lung, body of the liver and structures making up the back interfere with it posteriorly. In the front, the tympany of the often overlying transverse colon, an overhanging enlarged liver, and the resonance of left lung confuse the examination. Thus it is, that measures of assistance—such as artificial inflation of the organ, the accumulation of fluid in it, and the inflation of the colon—are of much practical value. In quite a few instances the examinations can be made in the first visit, without employing these, providing the organ is found to be distended with gases that have been generated in it. Sometimes, when in doubt, the single procedure of causing the patient to drink a glass of water (Dehio) and, in the upright position, percussing for a transverse dullness, or noting fullness by palpation (when the abdomen is thin and relaxed) it may be possible to note the position of the greater curvature. According to Penzoldt, this dullness in the normal stomach should be above the umbilicus, and when the stomach is atonic, below it—to the latter should be added the prolapsed stomach of gastroptosis. One should hesitate in making a positive diagnosis of dilatation or prolapse by this water measure alone. The umbilicus does not bear the same ratio of distance between the ensiform and symphysis pubis in all persons, and a stomach with its lower border below the navel is not always one that is atonic or ptosed. The determination of the upper border of the stomach likewise meets with many difficulties by unassisted percussion alone. Ordinary percussion, even over a stomach containing food, usually enables one to determine its fundic and upper left border.

The outline of the stomach is larger or smaller depending upon the various conditions. It is large in dilatation from any cause, in normally large stomachs, in long standing gastroptosis, in contraction of the left lobe of the liver and in pulmonic contraction of the left side. It is smaller in cirrhotic gastritis, in enlargement of the left lobe of the liver, in left-sided pleuritic effusion, emphysema and pneumothorax, and in splenic and heart enlargements. Lastly, simple percussion is an important physical measure in outlining tumors which may originate in the stomach. When much gas, fluid, or solid contents are present in the stomach the results obtained are always questionable unless the tumor is of large size. The measure is of more value in differentiating liver or pancreatic tumors from those of the stomach; because the first mentioned are always dull (the dullness of a pancreatic growth may be masked by a very gaseous stomach even in the Trendelenburg position of the body).

AUSCULTATION OF THE STOMACH.

Deglutition Sounds.—With the ear or bell of a stethoscope at the ensiform, two sounds are ordinarily heard during deglutition. The first is a squirting sound occurring as the fluid passes through the lower pharynx into the esophagus and is called by Ewald the "primary murmur." This is followed by a "second murmur" which is much louder, like the cracking of a large bubble, and occurs as the fluid from the gullet passes through the cardia into the stomach. The time between the occurrence of the two sounds is usually from five to ten seconds, although in some healthy persons the interval is shorter or prolonged beyond these. The first sound may be inaudible, and when noting the intervals between them, the raise of the larynx (occurring in the act of swallowing) can be timed in its place. The second sound is usually audible and best heard in the notch between the ensiform and the left costal margin. In a few instances it is observed best at the left of the tenth dorsal vertebra in the ninth or tenth interspace.

The noting of the interval of time it takes fluids to course through the esophagus has been used with some degree of success in diagnosing states of stricture in the gullet or cardia and a lack of motor power in the deglutitory muscles (esophagus). Under these conditions (particularly stricture) the second sound is delayed and may not appear for almost a minute, and the sound may be continued for some seconds (due to only small portions of the fluid going through at a time). Some hesitancy should be exercised in making a positive diagnosis of the above mentioned states on these sounds alone. I have seen normal individuals in whom the interval between them was as long as twenty-five seconds, and on the other hand, I have observed a case of quite general carcinomatous involvement of the esophagus (with some stenosis and a diffuse thickening of the canal) in which the sounds were but twelve seconds apart. When the sounds are heard depends much upon the force of the swallow, the amount of fluid sent down at one time, the length of the gullet, whether the stomach is empty of fluid or food and how much gas is in the upper (fundic) region, if the stricture is of large or small caliber, and the status of motor power of the uninvolved parts of the canal. Still, it may be taken as a practical fact, that if the second sound is heard inside of ten seconds stenosis in the course of the canal or at the cardia does not exist. Sometimes the absence of the second sound is of more value in noting stenosis of the cardia than the time in which it should occur. Manifestly, an irregularity in the surface of this orifice could

divert the course of the fluid causing it to run down the side walls of the organ and thus it might not be heard.

Recently a new swallowing sign has been described by Revidtzev[3] which he considers of undoubted value in the diagnosis of organic stricture of the esophagus. Revidtzev's sign consists in the fact that in stenosis, after the second sound is heard, if the individual be instructed to repeat the swallowing movements without taking more fluid, the sounds will again be heard. This procedure may be repeated three or four times in succession, each time with new sounds being heard. He describes the nature of this sign as follows: There is always more or less dilatation of the esophagus above a chronic stricture through which a single swallowing movement is not sufficient to force all of the contents through and past the stenosis, a considerable portion of the fluid remaining above and each additional swallowing movement forces more or less of the material past the narrow portion of the channel. The more marked the stricture, the more numerous will be the residual sounds, unless, of course, the stricture be one that entirely obliterates the lumen. The discoverer of this sign believes that it is of special value in the differentiation of organic from spasmodic strictures. Up to the time of this writing in the two cases in which the writer has employed it he has observed that it was present, although like all other swallowing sounds it may finally prove to have only a limited value in determining the existence of a stricture. It may, however, be found to be of value in the more or less annular strictures due to a cicatrix of long standing, but in malignant disease sharply confined and uniform strictured states are rare, and dilatation above the stricture is not so common. The latter disease may cause a quite general involvement of the esophagus, with much thickening of connective-tissue stricture above and below it, and still permit of a fair passage of fluids through the tortuous and roughened canal, but not allow the passage of foods or the olive of a bougie.

Sounds in the Stomach.—In the stomach itself sounds are often produced which may be described as cracking or fizzing, rumbling or gurgling, the succussion sounds produced within the organ, and those transmitted from the heart.

A rather constant series of small crackles is often heard in states of active fermentation of foods due to stagnation of stomach contents. Their absence, however, should not be used to argue against the existence of abnormal retention, since even in extreme states of pyloric stenosis they may not be observed. Loud rumbling, bubbling, gurgling, or squirting sounds are often synchronous with respiration and

may be heard some distance away. They are caused by the respiratory rise and fall of fluid, and (not so loudly) to the passage of chyme through the pylorus. These sounds are commonly heard in dilated stomachs or in gastroptosis, but should not be considered as strongly diagnostic of these states since they may also be heard in plain neurotic conditions and often in the normal stomach. The succussion sounds are those of the foregoing, together with the form produced by the shaking of the body from side to side or the voluntary change of position of the patient. They resemble the agitation of a small amount of fluid in a cask, and are also of diagnostic value in states of atony and stagnation. The heart sounds may be transmitted through a stomach containing much gas. They are commonly encountered in gastric dilatation, or when much gas is present from the fermentative or gas-producing neurotic conditions. When observed, they possess a ringing reverberating quality like the muffled sound of a bell. It is probable that in a relaxed stomach containing gas, the underlying abdominal aorta could also easily produce them. Benedict has described another form of sound for diagnostic purposes to determine the degree of acidity in the stomach. These are generated by the giving of bicarbonate of soda, which, coming in contact with the acid in the organ, causes the sound of effervescence. All of the foregoing mentioned sounds are more significant when very markedly observed, and particularly when present three or four hours after a simple meal, six or seven hours after the principal meal, or in the morning stomach before food ingestion. In these instances they are indicative of the delay of foods in the stomach from stenotic states of the pylorus, atony and excessive fermentation, or the existence of secretion of gastric juice in the empty stomach.

AUSCULTATORY PERCUSSION OF THE STOMACH.

The possibility of auscultatory percussion is made by the fact that different organs of the body have different densities of substance and character of make up—solid, or hollow. As a measure of physical diagnosis results from it are much to be preferred to simple percussion, but it has been my observation that for a relatively simple matter, easily learned, much difference exists concerning it between various medical men—some even in discouragement have given up employing it as a routine measure. This should not be so, because it is a fact that by its employment in the examination of the stomach, the adventitious sounds of the overlying liver and lung do not interfere with its accuracy (as in simple percussion), because the tympanic sound of

the underlying stomach is clearly transmitted through these organs. Like percussion, when both a distended stomach and transverse colon are present, it has its limitations in mapping out the lower border of the stomach. Still, ordinarily, the limits of the organ can be made out with precision, and often it is easy to detect the accurate site of the edge of the liver when it is too soft to feel by palpation or difficult to note by simple percussion. By care it is possible to map out the upper border of the stomach under the liver, and under the lung in the left thorax beyond the cardia to the limits of the fundus. Auscultatory percussion of the spleen to note its size is much more valuable than simple percussion. As Stengel has shown, and to which I fully agree, it is generally possible in tumor of the pyloric region to determine by auscultatory percussion whether or not it belongs to the stomach. The performance is easily carried out, and is of much value as a control to the ordinary method of percussion.

In beginning the examination by this method, place the chest piece of the stethoscope over the usual position of the fundus, at the sixth or seventh rib in the left mammillary line, or at the left side of the ensiform, and percuss near the stethoscope in order to fix in the mind the character of the stomach sound present. Noting this, maintain the position of the stethoscope bell and percuss to it from all positions beyond the stomach, starting well below, above, and to the sides of what may be considered as the limits of the normal stomach. It will be observed, when the stomach is distended with air or gas, that when the border of the organ is reached a sound of greater intensity, cleaner and higher pitch is observed, and a mark should be made on the abdomen to record this. The stroke should be lightly delivered and best by the employment of a pleximeter. To confirm the results, the percussion may subsequently be made from the stethoscope bell outward. By this method the position of the stomach area can be reliably determined.

As changes in the shape or size of the organ are noted, the bell of the stethoscope should be moved to correspond more to the body of the stomach, according to the suggestions found depicted on the following plate, and the edges of the stomach approached with a still lighter percussion stroke. If the method is used to ascertain to which organ an epigastric growth is attached—whether in the posterior wall, or superior curvature, or at the pylorus—the organ should be only moderately distended with gas and the small intestine should also be rendered somewhat tympanitic. Should the growth be in the liver or gall-bladder, the sound produced at A is quite different from that at C or D; while if it is in the small intestine, that at B is quite

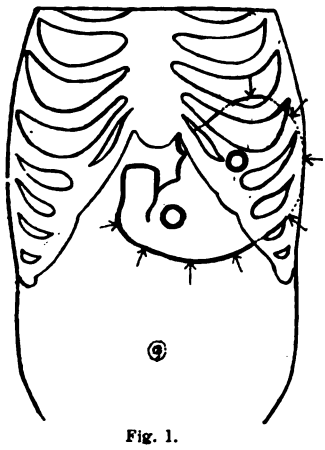


Fig. 1.

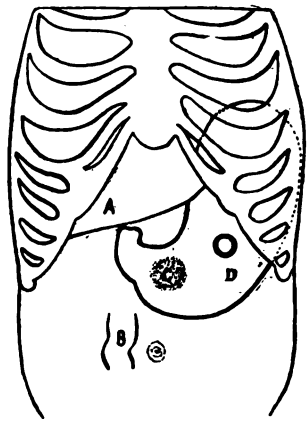


Fig. 2.

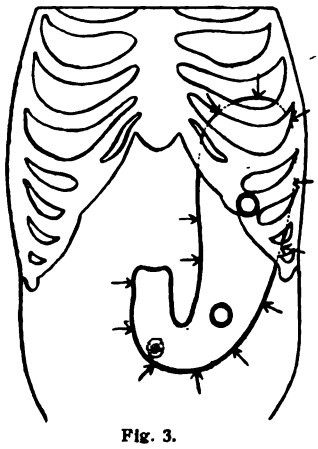


Fig. 3.

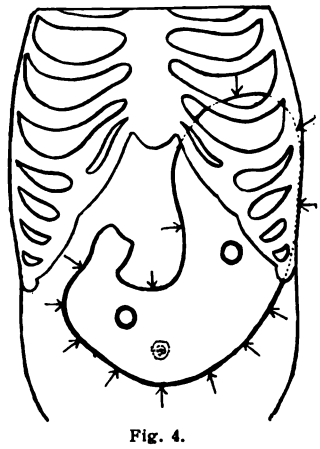


Fig. 4.

Fig. 17.—Auscultatory percussion of the stomach under different pathological conditions of that organ.

Fig. 1. Shows the two best positions of the bell of the stethoscope for percussion of the normal stomach. The upper circle for the limits of the fundus. The lower for the two curvatures and the situation of the pylorus. The arrows show the routes of percussion.

Fig. 2. Shows a method of determining by auscultatory percussion that a tumor belongs to the stomach rather than to the liver or intestine. If the tumor is in the wall of the stomach the percussion notes over points *A*, *B*, *C* and *D* differ, but *C* resembles *D* much more than does *A* or *B* resemble *D*. The author advises against pronounced artificial inflation in this examination.

Fig. 3. Shows the changes of positions of the bell of the stethoscope from Fig. 1, to map out the borders of the stomach in gastroptosis. The upper bell is lowered to the costal margin, and the lower one is swung downward and outward until it rests slightly inside of the outer transverse margin of the greater curvature (designated by gastric tympanitic note). The lower limit and pyloric portion of the organ can easily be made out from this position, providing there is not much food in the stomach, or under the conditions of sufficient inflation. Arrows show routes of percussion.

Fig. 4. Shows the best position of the stethoscope bell to map out a dilated stomach. The upper one is lowered onto the abdomen proper below the costal border, and the lower one is moved across to the right of the umbilicus. One is thus enabled to easily outline the stomach, especially when its contents have first been aspirated, and subsequently the organ is well inflated. Arrows show routes of percussion.

different from that of C or D. Auscultating percussion is quite valuable in differentiating malignant growths or enlargements of the gall-bladder and liver from those of cancer of the stomach. When doubt exists as to whether the tympany noted at the umbilicus is due to the lower border of the stomach or to distention of the colon, the placing of the stethoscope bell at the site of the transverse colon (slightly above the umbilicus in normal individuals and below this when it is sagged), and percussing along the course of the colon will usually clear this point. The sound at the colon is rarely the same as that of the stomach, and the difference noted, confirmed by special percussion of each organ alone, is of much practical value since both organs are usually distended throughout in the same degree and thus the sound of each is characteristic and separate.

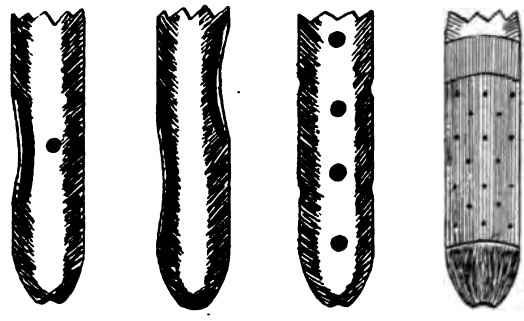
EXAMINATION BY MEANS OF THE STOMACH TUBE.

With the introduction and general utilization of the soft elastic rubber tube in the gastro-intestinal diseases, the possibilities of diagnosis and therapy have been placed upon a rational basis. Practical facts obtained by means of the tube have made its use positively indispensable, and after all has been written and said of the outside means of physical diagnosis, one must usually resort to the use of the tube for the best kind of work. By its employment, diagnostic aids obtained in a direct way and therapeutic results are possible which will always maintain the tube's position as the most valuable single apparatus in the work. By its use in removing stomach contents, a study of the digestive process in the individual is accomplished, the best form of treatment of many gastric conditions is possible, esophageal and cardiac stenosis may be diagnosed, and the position and size of the stomach can best be noted, not to mention its many advantages in colonic work.

Best Forms of Tubes to Employ, and Their Care.—It has never seemed to me (with the possible exception of esophageal work) that other than the soft form of tube should ever be used. The use of the hard forms of apparatus or English sounds, used sometimes to determine the position of the lower border of the stomach, should be discouraged as an unsafe and unreliable practice. If in a thin and relaxed abdomen (through which it is possible to feel the location of the end of a stiff instrument) the soft tube arranging itself along the greater curvature can as easily be felt, and, for obvious reasons, is less dangerous of employment. This measure of so called "sound palpation" can also be carried out in stout individuals (in whom the

tube *in situ* in the stomach cannot be felt from without) by using a very soft, or old tube, the apertures of which had been occluded or covered over with thin rubber (condom) and which tube had been filled to about one-third of its length with a bismuth emulsion. With the end of such a tube in the stomach, and the employment of the X-rays and fluoroscope, its position along the floor of the organ can readily be observed and the course that it had taken—which is always according to the depth and shape of the greater curvature—noted in the erect position, Bassler.[4]

A stomach tube, in my belief, should be soft enough to easily adapt itself to the curved course it must follow, and stiff enough so that it can be pushed downward without coiling or kinking easily in



Ewald. Boas. Rosenheim. Einhorn.

Fig. 18.—The end construction of the best forms of stomach-tubes. The Ewald and Boas tubes are used for test-meal extraction, lavage and gavage. The Rosenheim and Einhorn for douching the stomach.

the mouth, pharynx, or stomach. It must be composed of the usual elastic rubber composition, be on an average about 75 centimeters long, and about 6 millimeters thick, have a conical end with velvet eyes to the apertures, and large enough openings to permit of easy passage of fluid. In children, a narrower and shorter tube should be used, and in very tall persons one about 100 centimeters long, but not any thicker.

A fresh tube should be used for each individual, and these should be cleaned after use and carefully dried before put away. In clinic work, where fresh tubes for each case is not possible, a set of tubes, appropriately marked, can be used. The special tubes can be indelibly marked by silver nitrate, and certain ones always employed in each of the cases of cancer, tuberculosis, and syphilis. On every occasion, the tubes should be boiled after use, and kept in an anti-

septic solution (liquor creosolis compositus, or boracic acid) until used again. In hot and very dry climates, the tubes should be kept in a cool and moist condition, and where they are only occasionally used, taken from the box or jar in which they are kept and shaken vigorously at least once a week. Prolonged immersion in a carbolic solution or the coating it with petroleum jelly will often soften an old tube. It is best to keep them in a long box, rather than coiled in a jar; the reason of this is because after lying coiled up for a while they set permanently in the position they were in, and a tube for use should never have set curves of its own. The Boas tube with the two large fenestra is best for test meal extraction, with that of Ewald's a close second choice. Both of these are likewisely excellent for lavaging purposes, but for simple gastric spraying Türck's recurrent, Rosenheim's or Einhorn's are to be preferred. These latter are described under Chapter XIII.

Technique of Introduction.—The introduction of a stomach tube is a simple performance, not attended with any danger in suitable individuals, and to a great extent free from distress if properly and quickly performed. To those not familiar with its introduction, feelings of hesitancy and timidity usually cause more or less error, length of time that its passage takes, and consequently an increased degree of distress to the patient. The following points are offered to beginners for guidance.

Be sure that no contra-indications for its use exists.

False teeth on plates had best be removed, although in apprehensive patients if these fit tightly they may remain.

If chronic pharyngitis or other tender throat conditions exist precede the introduction by a spraying of the throat with a 5 per cent. eucaine, or a 10 per cent. bromide of soda solution.

Lubricate the tube by immersion in water, or with glycerin, or both.

Do not put your fingers in the patient's mouth to guide the tube (it is unnecessary), but grasp the tube far enough from the end so that the tip can be pushed down into the pharynx without shifting the hand holding it (about 5 inches from the end).

Assure the patient that its passage is perfectly harmless, and advise him to swallow when you tell him to.

With the patient's head in a natural position, introduce the tube rather quickly and steadily, and when you feel the tip of it impinge at the laryngo-pharyngeal junction, ask him to swallow and at this time deliver it beyond that point.

Gaining the esophagus, push it quickly downward hand over hand into the stomach. Slow the rapidity of introduction as the stomach is reached insisting upon the patient taking deep breaths through the mouth so that he will observe that breathing is possible with the tube inside. Should he incline his head backward push it forward.

Reassuring words to the patient during the performance often assures apprehensive and nervous individuals.

In withdrawing the tube, pinch the outer end firmly so that its contents will not flow from the stomach end of it into the patient's mouth or soil his clothes.

The best position for the physician is at the side of the patient with one arm around the individual's neck so as to prevent the head from going backward, and the hand of the same arm in front of the face so as to assist the other in the introduction.

A straight, high-backed, rather low and narrow-seat chair is the best for the patient to sit upon.

With all patients new to the passing of a tube, act as if its introduction was most familiar to you, and do not approach it as a first year medical school graduate would the performing of a laparotomy. Assistance is rarely required with the average patient, and with a little sangfroid or a perfectly natural demeanor on your part, the patient's fears are allayed, and the results obtained more satisfactory.

Contra-indications to the Use of the Tube.—The use of the tube for diagnostic reasons is not necessary in gastric cases that have an acute onset from a very possible cause; in gastric conditions which have existed for only a few days; when an apparently true diagnosis can be reached by the symptoms presented and the case is recent and not severe in nature; when, under the diagnosis made and the treatment for the condition is being carried on, the patient benefits and recovery seems to be logical to expect; when severe gastric symptoms —such as pain, marked post-meal distress, vomiting, etc., do not exist, or constitutional symptoms—such as progressive anemia, debility, loss of weight, cachexia, etc., are not present; when the symptoms in an abdominal case are more suggestive of disease of the liver, gall-bladder, pancreas, spleen, intestines, kidneys, etc., than that of a primary gastric affection; and under the following contra-indications:

When straining and vomiting are invariably caused by its passage and the case in nature does not seem to warrant persistence in its use.

In marked prostration from any cause.

In continued fevers.

In broken compensation of the heart from valvular lesions.

In advanced fatty or fibrous degeneration of the heart-muscle (chronic myocarditis), or angina pectoris.

In thoracic aneurism, and advanced arteriosclerosis.

In recent hemorrhages from any source (stomach, lungs, kidneys, brain, etc.).

In advanced pulmonary tuberculosis, emphysema and severe bronchitis.

In plainly evident neurasthenia or in hysteria and epilepsy.

In pregnancy, during menstruation, and in old age.

When the clinical symptoms of gastric ulcer, gastric carcinoma, gastro-enteric neuroses combine to make a diagnosis of these conditions most probable.

When in disease of other organs the gastro-intestinal conditions can be considered as secondary.

While the above contra-indications should always be borne in mind, occasionally in clinical work some liberties with them must be taken. Such a matter, of course, would depend upon the nature of the case, the condition present outside of the alimentary canal, and the desirability for the gastric analysis of a test-meal or lavaging. In the estimation of these, the exercise of judgment and dictates of experience of the physician are factors of importance. Often, diagnostic facts for therapeutic suggestions and direct therapeutic results are of assistance in cases of many of the internal medical diseases. I believe that in diagnosing the clinical type of gastric ulcer, the tube should not be used, but I do not agree with Flade[5] and Boas[6] that its use is not always justified in any suspected or atypical case of ulcer. While obviously in these cases, it would be wisest in the general way to advise against its use, and further, that usually little in the diagnostic way is gained by analyses of test-meals from these conditions, still, in a case of ulcer when the stomach does not present enough gross clinical symptoms to make a definite diagnosis possible, in some of the post acute gastric ulcer conditions and in the chronic forms of stomach ulcer, when skilfully handled and under favorable conditions, the employment of the tube is not attendant with any danger, and occasionally the diagnostic and often the therapeutic results possible of being obtained from its use would make it well worth the chance that is run—as was mentioned above, this always excepts gastric ulcer during the acute stage of its existence.

INFLATION OF THE STOMACH.

Of much help in the determining of the size, shape, and position of the stomach, including an outline of the greater and lesser curvature, and often the pyloric extremity, is the artificial ballooning of the organ. By this distention of the stomach by physical methods, the examination in short individuals, or when the stomach contains too little gas to elicit a distinctly tympanic note, is rendered much more simple and accurate. Among some of the decided benefits possible of being obtained in the diagnosing of stomach affections under conditions of inflation, may be mentioned the following: the shape, size and position of the organ from the costal margin downward can usually be brought into prominence in the abdomen. In this way, a dilated organ, by its large size, can readily be observed. Also, the prolapsed organ with the pyloric region prominent about the umbilicus be seen and easily percussed. Of still greater value is the institution of visible peristaltic movements seen under conditions of distention and not visible under ordinary conditions. In tumors of the anterior wall and pyloric region of the stomach the growth may be seen to move to the left of the midline and become more prominent; this is an important point in the differentiation of tumors situated or attached to the anterior portion of the stomach and those to the back wall, lesser curvature and deeply seated post-gastrically, for the tendency would be for the deep-seated growths to become less easily palpable or disappear altogether—this is particularly true of tumors of the pancreas, left kidney, or transverse mesocolon. Dilatation of the colon may be practised by means of a soft rectal tube and air forced through it by means of an atomizer bulb, and such diagnoses as rectal and colonic obstruction, prolapse of the sigmoid, gastric flexure and transverse colon, the presence of adhesions, site of a tumor or tender spot, and the presence of chronic appendicitis by the Chase diagnostic method, possible in some instance. To these ends for the stomach conditions one of two methods is employed, either the carbonic acid inflation with effervescing mixtures, or by means of a stomach tube and some apparatus to drive air through it so that it will collect in the stomach.

Effervescing Mixtures.—The first is ordinarily accomplished by the administration of 4 or 5 grammes (1 dram) of tartaric acid dissolved in half a tumbler of water, which is followed by an equal quantity of sodium bicarbonate dissolved in a like quantity of water. The chemical union between the two dissolved substances causes the liberation of free carbonic acid gas, which, collecting in the stomach, distends the organ. The drawbacks to the employment of this

method of distention are important to keep in mind; the distention often occurs too quickly, is beyond our control in its degree, and can only be reduced by the passing of a stomach tube to relieve the intragastric pressure. Even with only four-gramme doses of each of the ingredients of the mixture, a marked amount of distress may ensue, or even hemorrhage or cardiac embarrassment, not to mention the danger of perforation should an ulcer exist in the stomach walls or perigastric adhesions be present.

It is natural for any physician to desire on the first occasion of examining a patient, that as many details of information be grasped as can be. This, particularly in the quick rush of clinic work, would incline him to employ this ready-to-utilize aid to diagnosis. As case after case comes along, some with empty, some with more or less filled stomachs with fluids or foods, the natural tendency would be to employ the effervescing method, because it is simple, quick, regarded to be harmless, and does not require the passage of a stomach tube to bring the distention about. While, as above described, it was a method common with me for several years, and I may say it had never caused any serious immediate harm, there were enough unpleasant experiences with it to make me modify it severely. Another object for doing so was that one could never be sure, for obvious reasons, that the stomach of the patient before us was empty of food contents; one cannot by physical means observe that a stomach, we will say, is half filled. When the patient is in the upright position to drink these solutions, all of the gastric contents sink to the lower and pyloric regions, and it is only in the upper part of the stomach that the manufactured carbonic acid gas can collect. Assuming now for the purpose of reasoning that the capacity of that stomach is 2500 cubic centimeters, and that it contained 1250 cubic centimeters of food, on top of which was added the tumbler of water (250 cubic centimeters more) making 1800 cubic centimeters of non-displaceable contents in all, it must be plain that all of the gas generated would have to collect into the 700 cubic centimeters of space in the fundic end, and this accounts for the sudden unpleasant effects sometimes seen, in which the patient turns pale, gasps for breath, and cannot lie down until the accommodating cardia has relaxed expelling some of the gas, and the pressure upon the diaphragm displacing the heart forward has been relieved by the belching. I think that the employment of larger amounts of tartaric acid and sodium bicarbonate is a dangerous practice. To guard against this, in all instances, I suggest the following. With both solutions ready, that about one-half of the bicarbonate of soda solution be drank, and the patient lying down, per-

cussion be made. Should the gastric tympany not be sufficient, the other half is now taken and percussion again performed. In most cases sufficient HCl content is present in the stomach to generate enough gas for examination. If, however, this is not so, the tartaric acid solution can then be taken, first one-half and then if necessary the remainder. In this way we never can cause distress, never overdistend an atonic stomach, obtain a fair idea whether hydrochloric acid is present in that stomach, and how long so after meals (myasthenia, states of increased gastric juice secretion), and even have suggested a

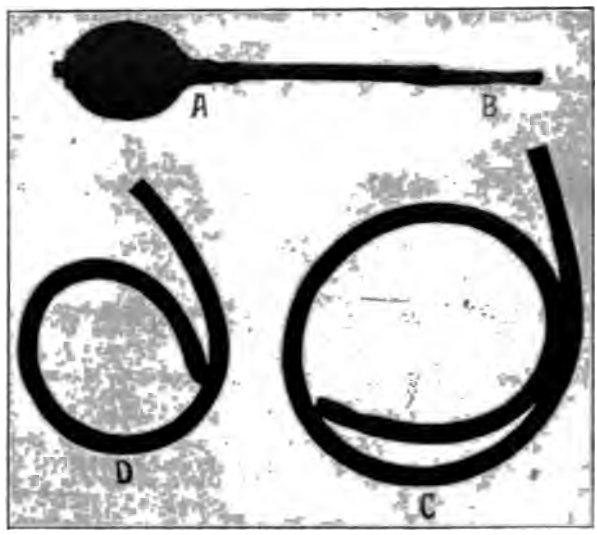


Fig. 19.—Inflation apparatus used by the author. *A*, Inflow bulb and tube such as is supplied with an ordinary atomizer. *B*, Short glass tube for connecting same with stomach tube (*C*) for inflating the stomach, or short colon tube (*D*) for inflating the colon.

diagnosis of marked stagnation with formation of organic acids usually found on these occasions since such acids will also decompose the bicarbonate of soda (cancer, pyloric stenoses). In the latter instance the formation of carbonic acid gas is slower and not so complete as when the tartaric acid had been taken.

Inflation by Means of a Hand Bulb.—The second and decidedly better method for distending the stomach is by means of a stomach tube and bulb. This method was first recommended by Runeberg, and can be utilized in the recumbent position of the body. It possesses the disadvantage of having to use a stomach tube, but by it the quantity of air delivered into the organ can be nicely regulated, and

after the distention (by removal of the bulb attachment) the stomach can again be relieved of the pressure. By this method, the air can be so regulated that the stomach can actually be felt in thin and medium subjects, and distinct palpation of the pylorus may be possible.

In the foregoing examinations it is most desirable that the stomach be empty of food contents, and with the employment of the bulb inflation, it is a good practice to instruct the patient to, by some prearranged signal, make known when any sensation of pressure, distress, or pain is experienced; at which time no more air should be pumped in, or in the event of the distress continuing some left out. In the ordinary run of gastric work it is not necessary to employ more than about 350 cubic centimeters of air for good results in examination. With a bulb having a capacity of about 70 cubic centimeters the

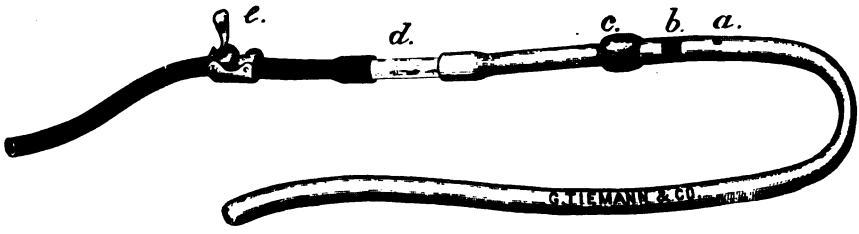


Fig. 20.—Autoinflation apparatus of Dr. Spivak. *a*, Side opening. *b*, Teeth mark. *c*, Sliding-ring. *d*, Glass tube. *e*, Clamp. In order that the tube used for autoinsufflation may not lose its usefulness as a stomach-tube in general on account of the side-opening, the tube is provided with a sliding-ring, as represented in the accompanying cut, which may be slipped over the side-opening when the tube is not used for insufflation.

delivering of this amount is accomplished by from 5 to 7 squeezes of the bulb. By the employing of the author's test-meal bottle this method of inflation can be expeditiously carried out after the extraction of a test-meal, requiring thus only the single passage of a stomach tube for both purposes. Page 142, Boas advises for the purpose the use of a double bulb. This is hardly necessary when a properly working single one is employed.

The contra-indications to inflation are gastric ulcer, marked atony, adhesions of the stomach walls, and cardiac disease, to which must be added when the stomach tube method is employed, the presence of those conditions in which its passage would be injudicious.

Occasionally, cases are met with in which after inflation the stomach rapidly empties itself of air, suggesting naturally a deficiency of the pyloric closing. While such might be the cause of the condition, it is rare to find clinically that the pylorus of those same stomachs

does not functionate properly when food is present in them instead of only air. In other instances again immediately after an inflation, a rapid series of belching so quickly empties the stomach that results from the method are modified. Patients after a little practice and instruction can usually control this satisfactorily. After inflation, examination, and marking the stomach outlines, aspiration of the stomach is desirable so that it is again collapsed. Inflation of the colon can be made by means of the same bulb attached to a colon tube. In this way the colon can be better examined to clear any doubts that may exist as to its relation to the stomach, and to which organ epigastric growths may be attached. See Chapter XXI, page 590. In tube broken patients the apparatus Fig. 20 may be used. It possesses no advantage over the simpler and easier to manipulate bulb method.

GASTRODIAPHANY.

Translumination of the anterior wall of the stomach by means of a small incandescent bulb introduced within the organ deserves mention as one of the methods of estimating the position of the lower curvature and the shape of the organ. In the rare instances of growths involving the anterior wall its use may be of diagnostic service.

According to Einhorn, who advanced the first form of instrument for the purpose of stomach work and who attaches much practical importance to its use, it is a quick method of diagnosing states of dilatation and prolapse, and of value to detect tumors of the anterior wall by their translucency. In all of these conditions, after a rather general and continuous employment of this method of diagnosing, I must say that its use is limited, and not to be preferred to the X-ray method, or physical examination when carefully performed. Much depends upon the slimness of the subject, and how marked in degree is the dilatation or the gastroptosis, for it is plain that when the patient has considerable subcutaneous fat on the abdomen (commonly encountered in gastroptosis as well as in other gastric conditions) only a very indistinctly illumined area is seen, and often no light at all excepting when the bulb is in the pit of the organ or near the anterior wall when an area about the size of the palm of the hand is observed and all else is dark. It must be quite apparent that when the area of light is brilliantly seen well below the umbilicus, states of enlarged or prolapsed stomach are strongly suggested, but in mapping out by means of the light the complete size and shape of the organ some degree of imagination is usually necessary after this to carry one

further in the diagnosis. The same limitation exists in mapping out the pyloric region, and when too much dependence is placed upon the observations made here, error in diagnosis is very liable to occur. The pyloric extremity of the human stomach is very deeply situated, and, when not prolapsed, is snugly covered over by the left lobe of the liver. Consequently, satisfactory translumination of this area is often impossible, particularly as the bulb, even when the instrument is introduced deeply, is liable to course upward to the lesser curvature some distance from the pylorus itself. Then again, when the light is in this portion of the organ it is so faintly seen from without that fine points of detail in the diagnostic way as to the exact position of the pylorus, and whether growths exist, are usually impossible. The

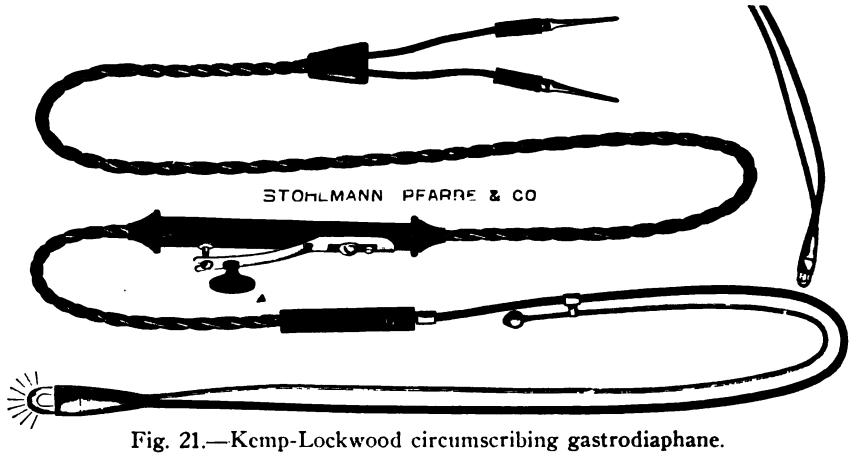


Fig. 21.—Kemp-Lockwood circumscribing gastrodiaphane.

author's use of the gastrodiaphane has brought him to the following conclusions.

It is a means of quickly noting the location of the greater curvature.

In thin subjects and under favorable conditions a diagnosis of shape and degree of prolapse of the stomach may be possible.

Taking a previously marked position of where the location of greater curvature had been as a guide, progress in cases of gastric dilatation can be noted.

In cases of growths at the pyloric region its employment may be a measure of confirmatory value, also in differentiating those of the gall bladder from those of the stomach.

Excepting in tube broken subjects, the Einhorn instrument, because of the thickness of the tubing and the length of time that

these examinations take, is not as pleasant to use as the modified forms of Lockwood or the Kemp-Lockwood instrument (which are much thinner and stiffer); and it is of additional value that the Kemp-Lockwood instrument, because of the accessory cable, is of service in moving the light from the greater curvature and along the lesser to the cardia under better control than with instruments not so supplied.

Before beginning translumination the stomach must be empty, and preferably also lavaged. It is to be recommended that the intestines (particularly the colon) be empty by previous fasting and purgation. A totally dark room in which to conduct the examination, and a battery capable of delivering sufficient current to brilliantly light the bulb are essential. The patient is examined in the upright position after swallowing one or two tumblerfuls of water so as to separate both walls of the stomach and facilitate the migrations of the instrument within the organ. The instrument is introduced quite the same as a stomach tube. I have always preferred to first turn on the current until the proper glow in the bulb is obtained, and introduce the instrument while so lit. My reason for this is that one could always be sure that the bulb was aglow in the stomach even when this could not be observed externally, still, with an apparatus in good working condition and the employing of a rheostat this is not over important. When the instrument is introduced, and the form above illustrated employed, the flexible cable is then drawn upon to cause the bulb to move in a circular manner toward the cardia, and depending upon which way the bulb points on the floor of the stomach the pyloric or fundic portions would be better illumined. It is important to remember, as Renvers has shown, that the transverse colon, which borders the lower line of the stomach, is also transparent to this light (shown by a crescentic area), and that the commingling of this area with that of the stomach site may lead one to believe that the lower border of the stomach is lower or higher than it actually is. The muscular planes of the abdomen and abdominal vessels in the wall also show confusing shadows, and fecal masses in the large intestine may give shadows closely simulating gastric tumors.

Kemp advises to increase the illumination of the stomach the employment of an alkaline glycerin solution of fluoresceine instead of plain water. For this purpose he first gives the patient a glass of water in which 15 grains of bicarbonate of soda had been dissolved, after which is given the second glass of water containing one dram of glycerin and about ⅙ of a grain of fluoresceine. Having employed this method on several occasions I believe it to be an improvement over plain water, but still its use leaves gastrodiaphany far short of

noting the size and shape of the stomach by the better results to be obtained by the older method of physical examination of the inflated stomach, and the still better X-ray method.

ROENTGEN RAYS IN THE DIAGNOSIS OF STOMACH DISEASES.

The advent of the X-rays into the art of medicine constitutes the most forward advance in recent times. While one could hardly enter upon the writing of this subject without also including some remarks upon its great value in the practice of surgery, dermatology, and the diagnosing of other than abdominal conditions, logically in such a work as this only the latter need be considered. When by the assistance of bismuth instillations into the stomach Rieder[7] was enabled to make accurate negatives showing the size, position, and form of the stomach, a way was opened in its employment for the diagnosing of gastro-enterological affections which, even in this short time, has made it the most valuable single measure of diagnosis at our command. From a method which was first supposed to have but little more virtue than locating foreign bodies of a metallic nature, the results from its employment in this field of medicine to-day may briefly be said to be as follows:—

It is the most accurate method of diagnosing the size, shape, and form of the stomach (dilations, cirrhotic gastritis, gastroptosis, hour-glass contraction, the binding down of perigastric adhesions, etc.).

It is a simple method of observing the presence of obstructive disease situated anywhere in the alimentary canal (cancer, cicatricial contraction, etc.).

It is a most useful method of diagnosing abnormal states of motility and mobility of the stomach (hypermotility, stagnation, the uplift possible to be obtained by artificial means in a gastroptosis and that any supporting measure applied is doing its intended work, etc.).

It is occasionally of value in directly diagnosing growths in the stomach walls, their size, mobility and location.

Its use often shows the presence of swallowed metallic articles located anywhere in the alimentary canal (when these are of some size).

It is also of value in diagnosing the presence of gall, renal, uretal and enteric calculi when these have calcium in their make-up.

It may be used in noting the position and size of the kidneys, in the way of diagnosing renal tuberculosis, new growths, and nephroptosis.

It is also of service in accurately diagnosing the position, size, and shape of the colon (coloptosis, colon dilatation, the existence of mild states of enteric stenosis from perigastric or pericolonic bands, prolapse of the sigmoid, etc.).

The Normal Stomach.—In beginning the consideration of X-ray diagnosis a few remarks on the position and form of the normal stomach are in order. In the recumbent position the stomach is situated at a higher level in the abdomen and is somewhat different in shape than the same stomach when the body is upright, particularly

Fig. 22.—Roentgenograph showing the position of the normal stomach and transverse colon. Note that the greater curvature of the stomach is well above the shadow of the coin at the umbilicus, and that even the transverse colon is above it. The upper coin represents the location of the ensiform process. (*Pfahler.*)

when it contains fluid or food contents. It is this raising of the stomach to the higher plane, the gravitation of fluid contents to the posterior surface of the organ, the accumulation of the contained gases between this content and the anterior wall, together with the relaxation of the tone of the abdominal muscles which makes the results of percussion of the organ in the recumbent position so much better than in the upright. Therefore it is important, since most of our active life is carried on in the upright position, that we determine the form and position of the stomach in this posture. The Roentgen method is the only accurate means of obtaining this information.

Quoting Pfahler,[8] whose observations may be taken as a standard

for practical use, the normal stomach is described by him as follows: "The normal stomach when empty or moderately filled occupies the left side of the abdomen, and extends from the inner two-thirds of the left dome of the diaphragm to the median line, usually about an inch above the umbilicus. The upper two-thirds is almost vertical, and the lower third almost horizontal, making the general directions of the stomach slightly oblique. The stomach of the average individual in the standing posture extends to or below the umbilicus, the pyloric portion extends from one to two inches beyond the median line to the right. I believe there is no difference in general between the normal stomach of the child and that of the adult." To these observations, to which I closely agree, I wish to add that the normal stomach of women is generally found to be somewhat lower than in men—this pertains only to the pyloric one-third.

Roentgenographic Observations of the Abnormal Stomach, Etc.—Both the fluoroscope and the photograph X-ray plate are used in making these observations. The first method may be used to observe the peristaltic function of the esophagus and stomach, and under favorable conditions, to observe the shape, size and movements of the stomach and the colon. If a patient swallows a capsule of bismuth it will usually lodge for a second or two at the level of the arch of the aorta and then pass quickly into the stomach. Should it lodge for some minutes in the course of the canal or at the cardia, the existence of a stenosis is suggested. Should a bismuth mixture be used, it passes quickly to the lower third of the gullet and here remains for a few seconds before the sausage-shaped mass disappears below. Should this large shadow continue to be observed at the cardia for ten seconds or longer, states of stenosis at that site would be suggested. In instances where the bismuth capsules pass downward rather steadily but take over fifteen seconds to reach the stomach may be cases of general thickening of the esophagus or affections involving the motor-power of the canal. By means of about half an ounce or more of free bismuth within the stomach, the position of the greater and lesser curvatures and pyloric region can quickly be observed. By employing about double the above quantity of bismuth the position and shape of the transverse colon can often directly be observed twenty-four hours after its ingestion, or, when only the colon is to be outlined, it is a better way to give the bismuth emulsion as an enema in the left position with the hips slightly raised. A colon tube is not necessary to deliver the emulsion high in the bowel because in ten or fifteen minutes after the injection, even when a short tube is used and providing the lower bowel is clear of accumulated feces, the bis-

Fig. 1.

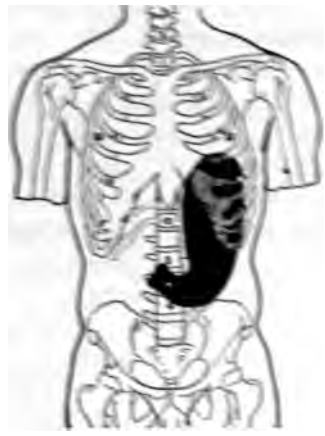


Fig. 2.

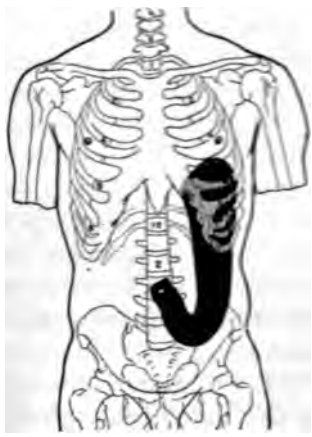


Fig. 3.

Fig. 4.

Fig. 23.—Degrees and types of gastroptosis compiled from 89 roentgenographs in the author's possession. The white dot represents the location of the umbilicus.

Fig. 1. Moderate degree of descent.
Fig. 2. More advanced condition than the above. (Some dilation.)
Fig. 3. Extreme degree of ptosis. (Vertical stomach.)
Fig. 4. A not uncommon picture of a type of gastroptosis accompanied with an extreme degree of dilatation.

muth by antiperistalsis will be found to have reached the hepatic flexure. Another method is to give about 25 grammes of bismuth subcarbonate about forty-eight hours before the taking of another like quantity just before the exposure is made; the first outlining the colon and the second the stomach on the same plate. By means of the fluoroscope, the presence of metallic articles of some size may be observed in the alimentary canal.

Because of the fact that important shadows are not possible of being observed, or if so too indistinctly by the eye, the use of the skiagraph method for making diagnoses is much to be preferred over the fluoroscope. By this means a permanent record containing much finer details of anatomy for leisured interpretation is obtained. It is always best to make one's diagnosis from a negative rather than from a print of it, since in the latter some of the detail is invariably lost. By the photograph plate method much better results are obtained of the size, shape, and position of the esophagus, stomach, and intestines, as these may be important. Diagnoses of stenotic conditions: dynamic errors of the stomach, such as hypermotility, hypomotility or stagnation; the presence of calculi or metallic foreign substances in the abdominal organs, kidney conditions, and so on, are all possible of being reproduced in outline in negative picture upon a plate. I may be pardoned, in the light of my enthusiasm on this method of diagnosis, to again state that it is the most valuable single method of examination at our command, and that while an X-ray outfit is somewhat expensive, and considerable time is consumed in doing this work, keeping the outfit in order, and developing the plates, that from the fact that by it it is possible for the internist to successfully make his own observations, the benefits are inestimable and well worth the while. Its use may be said to be as necessary in gastro-enterological work as is the employment of the ear in diagnosing heart and lung conditions.

I would like to add a few remarks, however, on some of the dangers of error encountered. A negative which is taken immediately after a bismuth mixture had been swallowed which shows scattered black patches produced by bismuth (which has been sent through the pylorus into the intestines) is not so liable to be suggestive of the existence of a relaxed pylorus as it is a hypermotility of the stomach. Peristaltic movements of the stomach induced by the presence of the bismuth mixture in the organ may give an irregular line to the stomach curvatures and radiations over the body of the organ closely resembling those produced by new growths involving the gastric walls. A notch seen in one of the curvatures of the stomach is not

always due to organic states of constriction, or to the existence of perigastric adhesions—a skiagraph taken the next day may prove that it was only a hesitating peristaltic wave near the pylorus that produced this marking. Gastric and extra-gastric growths, unless of large size, may not show their presence on a plate. A colon loaded with bismuth and feces may sag (coloptosis), which if empty would be in good position. Plates of gall-stone cases may not manifest that stones are present in the gall-bladder—they may be too small, or contain too little calcium to cast a shadow. Two or more plates made at different times but under the same conditions are essential in making most diagnoses. Like laboratory examinations, these observations are of most value in the positive findings—not in the negative. The employment of the X-rays is a measure of diagnosis along with history and older physical methods of examination to arrive at a diagnosis—not a means alone.

Apparatus, Preparation of Patient and Technique.—The first requisites are a good coil and tube. These should be located in a dark room so that the eye can appreciate the shadows formed on the fluoroscope screen. Coils for the purpose should be built strong enough to stand the tension of a heavy charge of current, and be able to maintain this strong current for a few moments without danger to the insulations. Such good quality coils are now built by a number of manufacturers in this country and throughout the world. In the matter of selection of an interrupter my experience has been that those attached to the coil and the Wehnelt form are much to be preferred to those containing a large quantity of fluid—such latter forms of interrupters offer too much resistance to the current for quick enough work or clear pictures. A foot or hand switch to turn on and off the current as well to control its rate of flow is a desirable adjuvant when an assistant is not on hand. Some apparatus to shut off all rays from the tube excepting those which pass directly forward may be found to be of service; a lead covered case or a diaphragm apparatus answers for the purpose. My habit has been to employ the tube as it is, and then if detail observation of a certain locality is desired (such as the pyloric region) to center the rays at that point by the use of the above, or by employing a lead glass-tube having a flint glass window. The confusing soft rays from the tube may effectively be cut out by the interposition between the tube and patient of a square of ¼ inch wood, or several thicknesses of oiled or wax paper. These, therefore, mitigate the danger of burning the patient—since it is the soft rays that mostly affect the skin unfavorably and are liable to produce X-ray dermatitis and burns. For this purpose the entire apparatus may be

contained in a closet against the closed door of which the patient r stand during the observation. Since most of the skiagraphs ta are in the upright position of the body some contrivance is necess to support the plate for the picture. The following inexpensive a easy to construct affair is satisfactory in my hands.

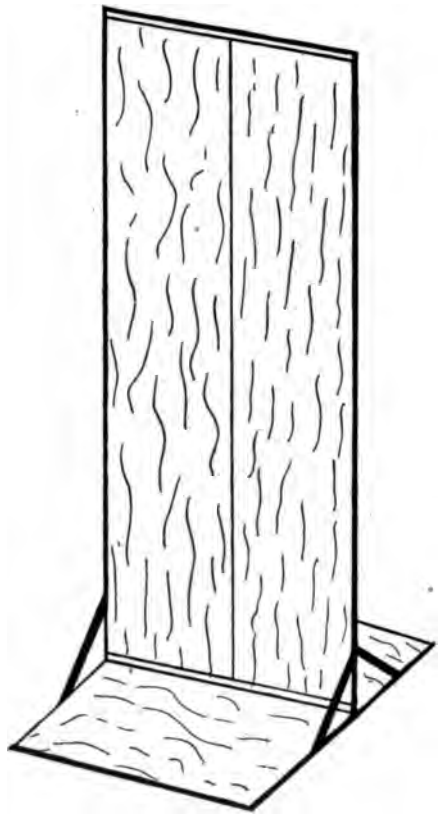


Fig. 24.—Author's floor-stand to hold the X-ray plate. The upright is five feet high and two feet broad. The foundation on the floor is wide enough so that it will stand without tilting over easily, and so that the patient can stand squarely upon it to support the upright and keep close to the plate. The plate is adjusted in place, by means of tacks according to the height of the individual and the chest or abdomen taken. The stand is built of wood and iron brackets at the base.

Of late a new form of tube energizer has been advanced for X-work. The apparatus consists of a double motor, the one side run the commercial current which generates on the other an alternat current which passes through a "step-up" to raise its voltage. motor shaft also runs a contrivance which converts this alternat

ırrent into a unidirectional one which comes of the binding posts. 'his current is of such high voltage and free from inverse that from ne to three-second exposures are all that are necessary to make good adiographs through the abdomen. The advantage of this type of ıpparatus is apparent when one considers that the quicker the exposure the sharper are the stomach outlines, the less danger there is of burning the patient, and the easier it is on the tubes. With the best of coil and technique and when using about forty ampères of current a good plate requires about ten seconds exposure, while with the transformer this is only about one-third. The author presents plates made by the two types of generators, and the sharpness and brilliancy of those made with the transformer as compared to the foggy ones made by the coil stand out in sharp contrast.

The proper tube to employ is one capable of withstanding a strong current (heavy enough anode) and is hard enough (high vacuum) to pass the rays through the body. A softer tube (lower vacuum) is preferable for fine detail work such as obtaining shadows of growths, or in gall-stones. The proper size of plate to employ is 11 x 14 or 14 x 17 inches; smaller sizes are not large enough to obtain a negative of the entire abdomen or chest of an adult, but may be used for the diaphragmed pictures.

Preparation of the Patient and Technique.—The examinations are made with the stripped patient standing before the tube; with women a light weight kimona may be worn at the time. In stomach work it is essential that the organ be empty of food, but in esophageal or intestinal observations this is a matter of indifference. In abdomen exposures it facilitates matters to have landmarks at the ensiform and umbilicus. For the purpose two coins are employed fastened to the body by means of short strips of adhesive (not Z. O.) or court-plaster. The target of the tube should be about 20 inches from the plate, and be on a level with the part of the body examined; for the esophagus about opposite the sixth dorsal, for the stomach level with the navel, and for the intestines, gall-bladder, etc., the third lumbar vertebra. The tube should be transverse to the body and slightly to he left of the spinal column, excepting in gall-bladder work when the ght side should be exposed, and in negatives of the intestines alone, irectly in back of the spine. The apparatus should be in prime workg order before the X-rays are turned upon the patient, and the amination by means of the fluoroscope or to make a negative should as short in duration as possible. Just how long an exposure to tain a good plate should be, depends upon the thickness of the body the patient, the amount of current employed and the sensitiveness

of the plate. Less current may be employed for fluoroscopic observations, which necessarily will be prolonged to some minutes. In plate work, the quicker the exposure, the clearer the detail on the negative; although it should be remembered that an overexposed X-ray plate is much to be preferred to one that is underexposed. The developing of these plates is done by the usual methods of dry plate photography.

In order to render the alimentary canal visible by means of the rays some material must be introduced which is either more or less opaque than the body soft tissues. As bismuth subnitrate (being a metal salt) obstructs the rays and is harmless to the body (when it is of good quality and does not contain arsenic), this is used to block out the outline of the hollow viscera. Gas may be employed either directly or generated in the tract by means of effervescing solutions to differentiate the densities of the soft tissues.

The ideal bismuth food or mixture must have a known quantity of bismuth subnitrate, be quickly prepared, and easily taken. It is desirable to use a viscid vehicle so that the salt will remain in suspension for some time. For this, kefir, koumiss, zoolak, or an acacia menstruum serves the purpose well, although its mixture in strained apple sauce has my preference. For an adult, about 30 grammes (1 oz.) of bismuth is the proper amount to employ for picture work, and this quantity may be kept in separate packages so as to be handy and save time.

In esophageal work it is better to use the kefir or acacia bismuth mixture so that it can be drunk at the time of the observation or the taking of the picture. In obtaining a negative of the gullet, the patient, plate, and all should be in position, and when a number of swallows of the bismuth food had been taken the exposure made immediately. In stomach observations this haste is not desirable, and it is best to allow the patient to swallow the apple sauce or fluid mixture leisurely some minutes before the exposure, so that it can all be taken and to allow time for the bismuth to well coat the interior of the entire organ to the pyloric extremity. To obtain pictures of the intestines time must be allowed for the bismuth to reach that part of the canal. Under normal conditions practically all of the bismuth in the small intestine in from six to twelve hours after ingestion, at the ileocecal valve in from twelve to fifteen hours, in the transverse colon about twenty-four hours, and in the sigmoid about thirty-six hours. A negative of the stomach can be made on one day, and without giving more bismuth a good picture of the colon can usually be taken on the next at the same hour. When just the outline of the colon is desired,

some fluid forms of bismuth mixture can be introduced by enema as was mentioned before.

It is desirable at times to obtain a perfect outline of the stomach and colon and note its size under moderate distention that a small quantity of tartaric acid and sodium bicarbonate separately in solution be given just before or after the bismuth mixture is swallowed; in quick colon observations the intestine could be distended by means of a hand bulb. Should the bismuth mixture have been employed by enema, the distention by air should be delayed until immediately before the picture is taken (some minutes after the bismuth enema).

When a new growth of the stomach is to be outlined it may be desirable to take the picture with the patient lying on the left side (plate in front), or in the upright position with the tube at the right of the spine so that the rays can shine across the pyloric extremity from back to front and slightly to the left. It should always be remembered that the plate should be to the back or front of the patient according to location closest to the situation of the organ examined—therefore it is, that in stomach, colon and gall-stone work the plate should be at the front, and in kidney pictures at the back.

Of late years, several cases of poisoning from bismuth subnitrate have been reported. In studying the literature I have observed that most of these were instances in which the bismuth salt had been freely used either externally on burns of large extent, or internally over long periods of time. Beck, who recently reported a case with necropsy, in part drew the following conclusions. "In the presence of certain bacteria, or the feces of children, bismuth subnitrate will liberate nitrates which will be absorbed by the intestines and eliminated by the kidneys; and if the production is faster than the elimination, methemoglobinemia will result. In larger doses per os, bismuth subnitrate is liable to produce an acute nitrate poisoning, characterized by collapse, methemoglobinemia, and may result fatally. Rectal injection of bismuth subnitrate may cause nitrate poisoning much quicker and more severe than when the drug is taken per os. Persons suffering from intestinal putrefaction are more susceptible to nitrate poisoning when taking the subnitrate internally." Although I have never had any ill effects from the use of the subnitrate on the many occasions I have employed it, in the past year I have used the subcarbonate instead, and must say that for picture and fluoroscope work it is even to be preferred to the subnitrate.

The depth of contrast produced by the bismuth salts depends upon the amount of elemental bismuth that the salt holds in com-

bination. Comparing the subnitrate ($BiONO_3 + H_2O = 304.71$) with the subcarbonate ($(Bi_2O_2CO_3)_2 + H_2O = 527.53$) it will be noted that the subnitrate contains about 68 per cent. and the subcarbonate about 82 per cent. of elemental bismuth. The latter, therefore, is not only preferable to use for the reason of safety, but not so large a quantity of it is required for these observations—compared to 30 grammes or 1 ounce of subnitrate, 23 grammes or about 400 grains of subcarbonate would be its equivalent in bismuth content.

GASTROSCOPY AND ESOPHAGOSCOPY.

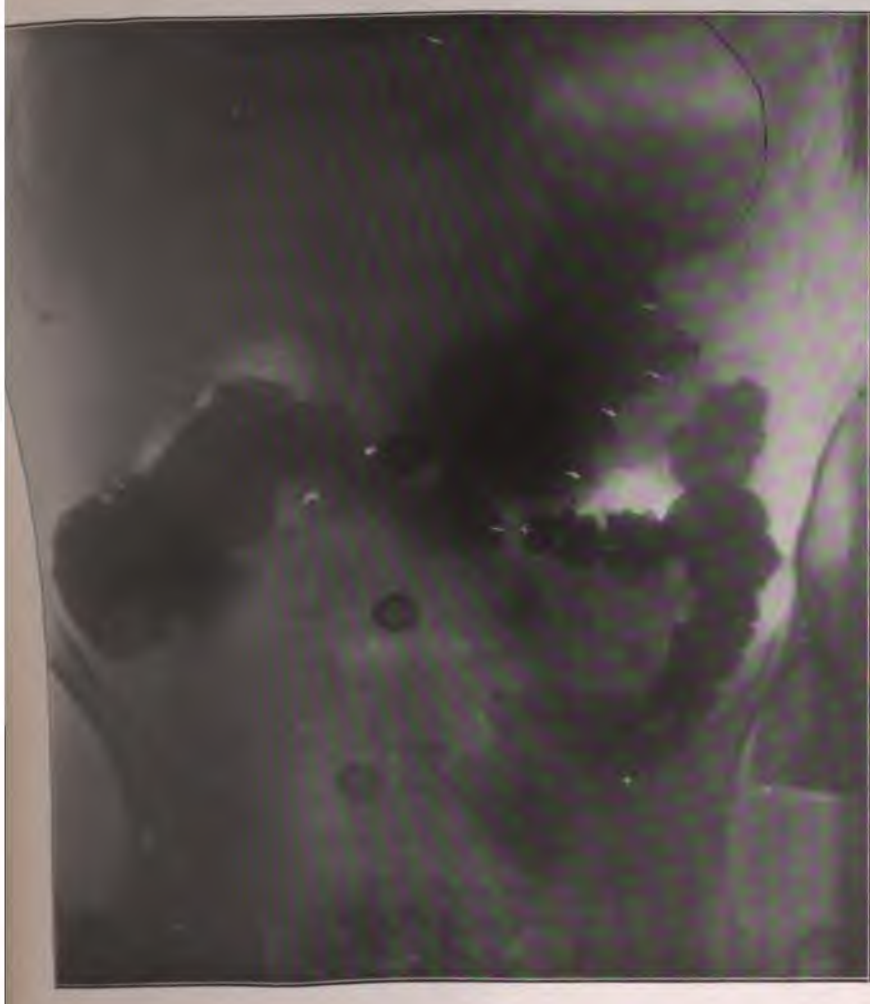
One hundred years ago (1807) Bozini directly examined the upper end of the esophagus, and from that day to this at various times with new forms of instruments workers in medicine have brought this method of diagnosis into direct attention. While the employment of the endoscope had in former years but a very limited value in medicine, of recent times with the newer forms of instruments and more general understanding of their use and improvement in the technique of employment, its use to-day is worthy of practical consideration in diagnosing some of the esophageal and stomach conditions which come under observation. While any method by the means of which we may gain a direct view of the internal organs will always hold a place of importance in diagnosis, endoscopy of the esophagus and stomach or the upper respiratory tract will always have a limited application in medicine mainly because of the distress incident to these examinations. Added to this is an element of danger to the passage of this instrument unless done by one who has had sufficient experience with it, and the fact that, in so far as stomach work is concerned, its diagnostic advantages are modified because all of the interior of the stomach cannot be explored and that the endoscopic fields observed are not always distinct enough for definite diagnosis. Still any physician after a little study and practice can use this instrument with most signal help in some of his cases.

The instruments used up to to-day may be divided into the older ones through which the illumination had to be thrown down the tube from the outside (Mikulicz, Rosenheim, Kelling), the recent one which has a "cold lamp" on the distal end of the tube near the area explored (Einhorn, Jackson). In 1906 Jackson improved upon the Einhorn instrument (which was an esophagoscope), and advanced an instrument by means of which the interior of the stomach could be explored—by having a longer tube than the esophagoscope—and

PLATE IV.

Roentgenogram of a case of carcinoma of the esophagus under the care of Dr. J. M. Anders, made by Dr. George Pfahler, Philadelphia. The upper level of the carcinoma is indicated by an arrow above which is an accumulation of bismuth.

PLATE V.

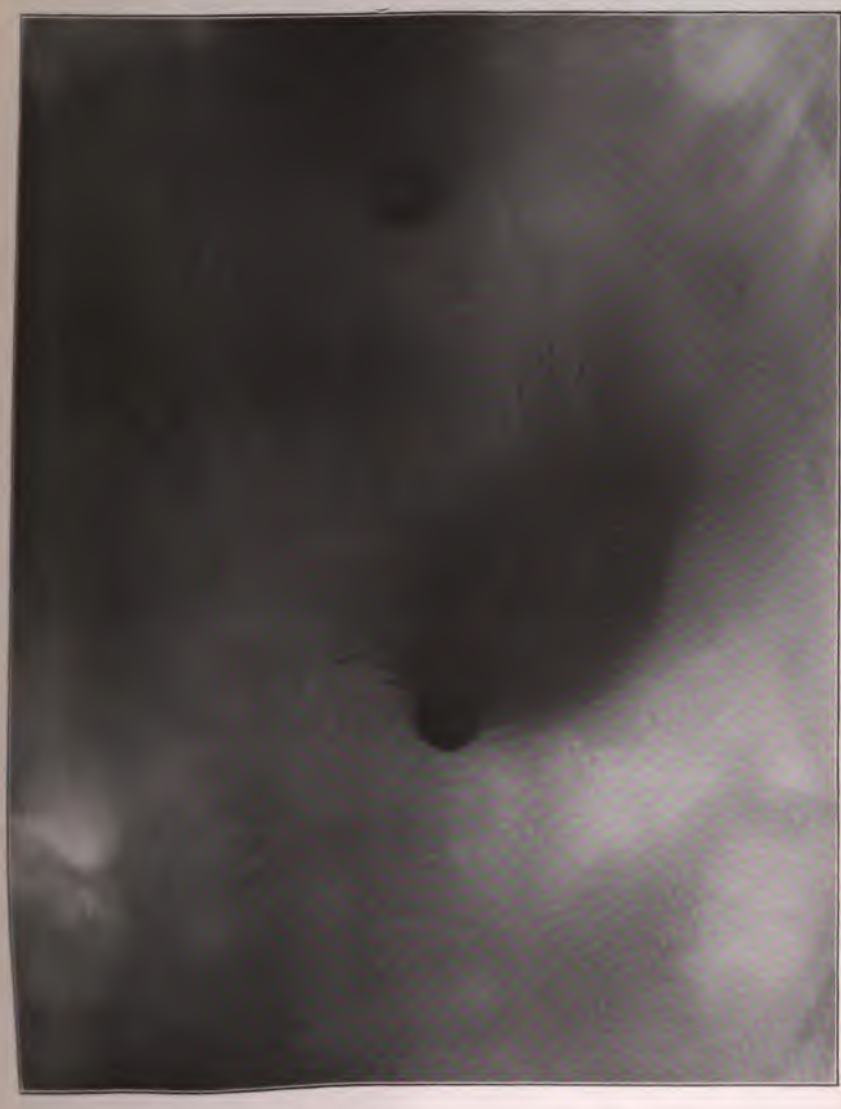


Carcinoma of the stomach, from the service of Dr. J. M. Anders, in the Medico-Chirurgical Hospital, Philadelphia. Examined by Dr. G. E. Pfahler. The carcinoma is outlined by the bismuth mixture in the stomach. Confirmed by autopsy.

PLATE VI.

Deformed stomach from adhesions incident to cancer of pancreas. *S, S,* Stomach. *F, F,* Fundus. *P,* Pylorus. *C o,* Cardiac orifice. *Ch,* Channel. *Di,* Diaphragm. *Oe,* Esophagus. *g, g, g, g, g, g,* Gas. *X,* Axis of rays. (Skiagraphed by A. W. Crane, Kalamazoo, Mich.)

PLATE VII.



Carcinoma ventriculi et pylori. Roentgenograph of a case of gastric cancer of considerable extent in a very emaciated patient, in whom the growth was not palpable from without. The picture shows the greater curvature plainly, but the lesser curvature is indistinct with plainly visible infiltration extending therefrom over the body of the stomach. On operation the next day by Dr. Raymon Guiteras the posterior wall and lesser curvature were plainly involved as the picture shows. (Case in the service of Dr. Charles H. Lewis.) Stomach shadow traced from plate.

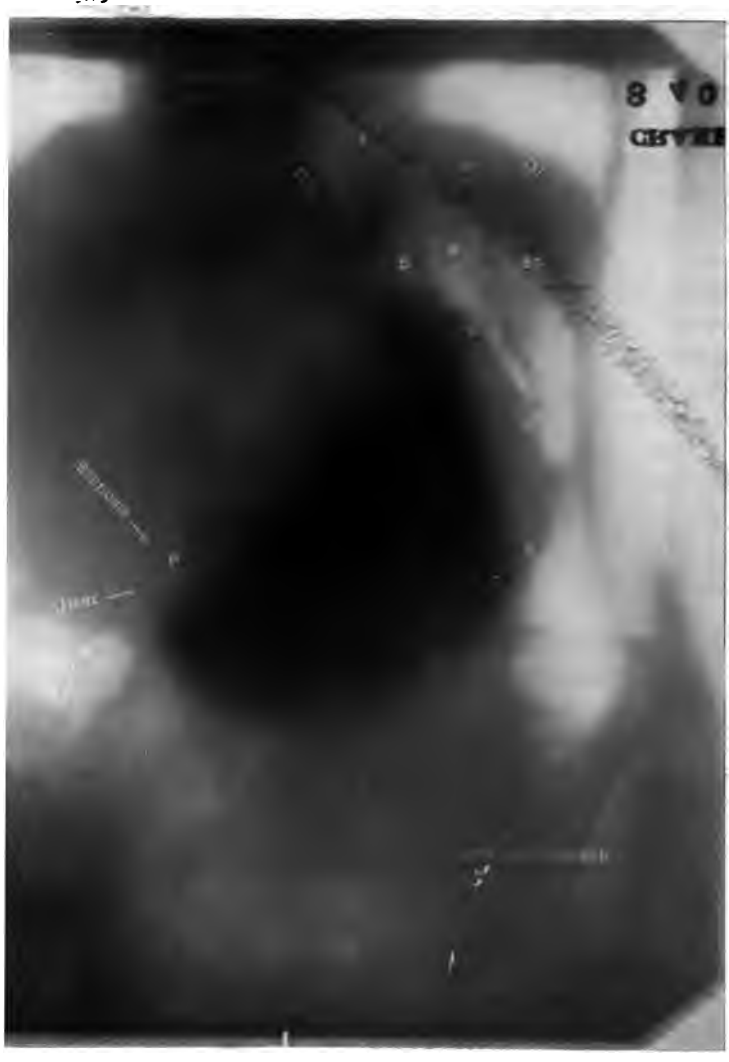
PLATE VIII.

Deformed stomach. Indentations from malignant growth in wall. *S, S, S,* Stomach. *F, F,* Fundus. *L c,* Lesser curvature. *G c,* Greater curvature. *P,* Pylorus. *g,* Gas in fundic end. *C o,* Cardiac orifice. *Di,* Diaphragm. *Sp,* Spleen. (Skiagraphed by A. W. Crane, Kalamazoo, Mich.)

PLATE IX.

Deformed stomach by indentation from tumor. Outside of wall. *S, S, S,* Stomach. *F, F,* Fundus. *C o,* Cardiac orifice. *L c,* Lesser curvature. *G c,* Greater curvature. *P,* Pylorus. *D,* Duodenum. *g, g, g,* Gas. *H,* Heart. *Sp,* Spleen. Stomach rugæ plainly shown. (Skiagraphed by A. W. Crane, Kalamazoo, Mich.)

PLATE X.

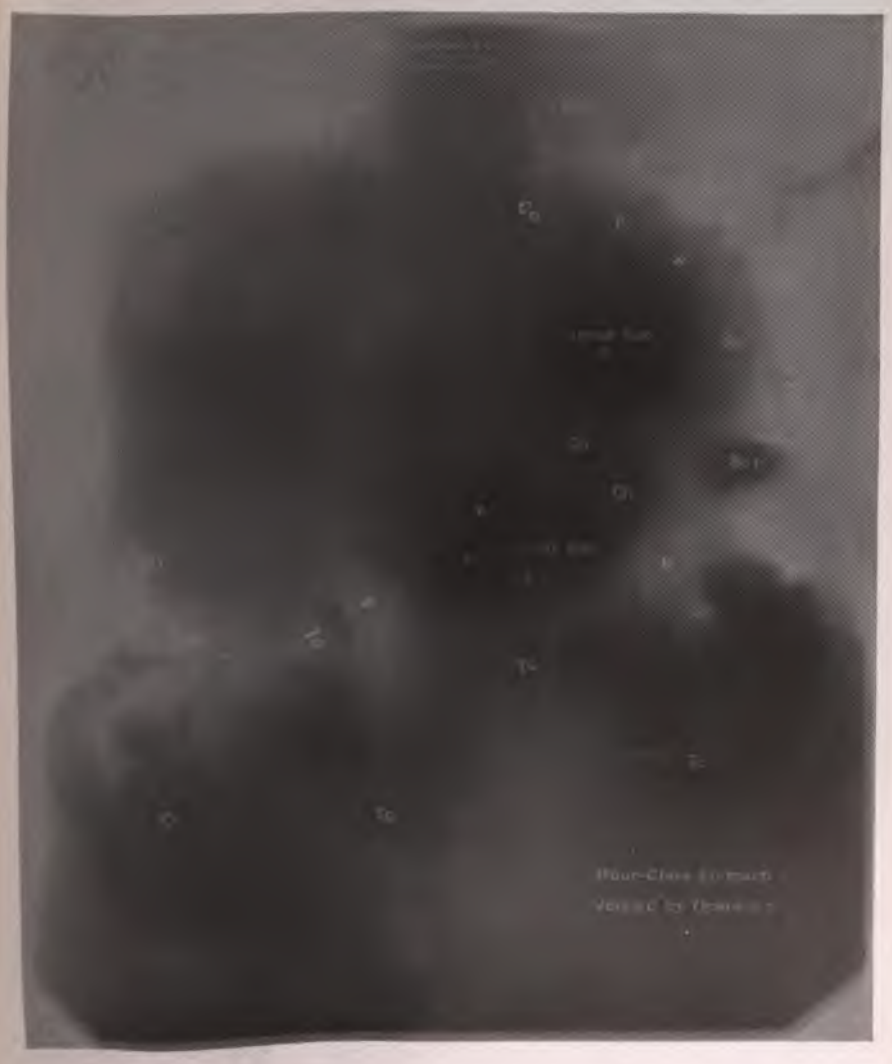


ited ("globular") stomach, due to pyloric stenosis following ulcer. Stomach. *F, F,* Fundus. *C o,* Cardiac orifice. *P,* Pylorus. *L c,* ırvature. *G c,* Greater curvature. *g,* Gas. *Di,* Diaphragm. *Sp,* *k, k, k,* Kidney. (Skiagraphed by A. W. Crane, Kalamazoo,

PLATE XI.

Hour-glass stomach. *S, S,* The two sacs. *Ch,* Channel between them. *P,* Pylorus. *D, D,* Diaphragm. *U,* Umbilicus. *X,* Axis of rays. (Skiagraphed by A. W. Crane, Kalamazoo, Mich.)

PLATE XII.

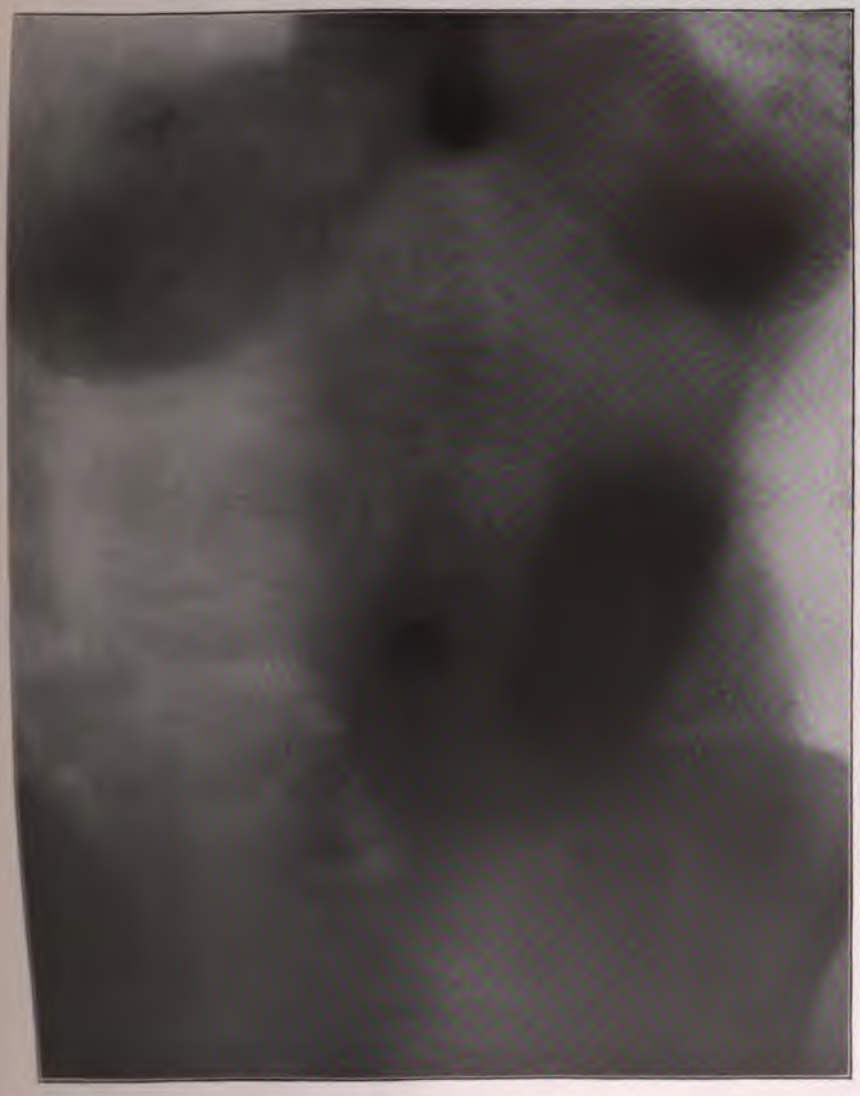


Hour-glass stomach. *S, S,* Stomach. *F, F,* Fundus. *P,* Pylorus. *Ch, Ch,* Channel between the sacs. *C o,* Cardiac orifice. *Di,* Diaphragm. *C,* Cecum. *A c,* Ascending colon. *H f,* Hepatic flexure. *T c, T c, T c, T c,* Transverse colon. *Sp f,* Splenic flexure. *Sp,* Spleen. *g, g, g, g,* Gas. X, Axis of rays. (Skiagraphed by A. W. Crane, Kalamazoo, Mich.)

PLATE XIII.

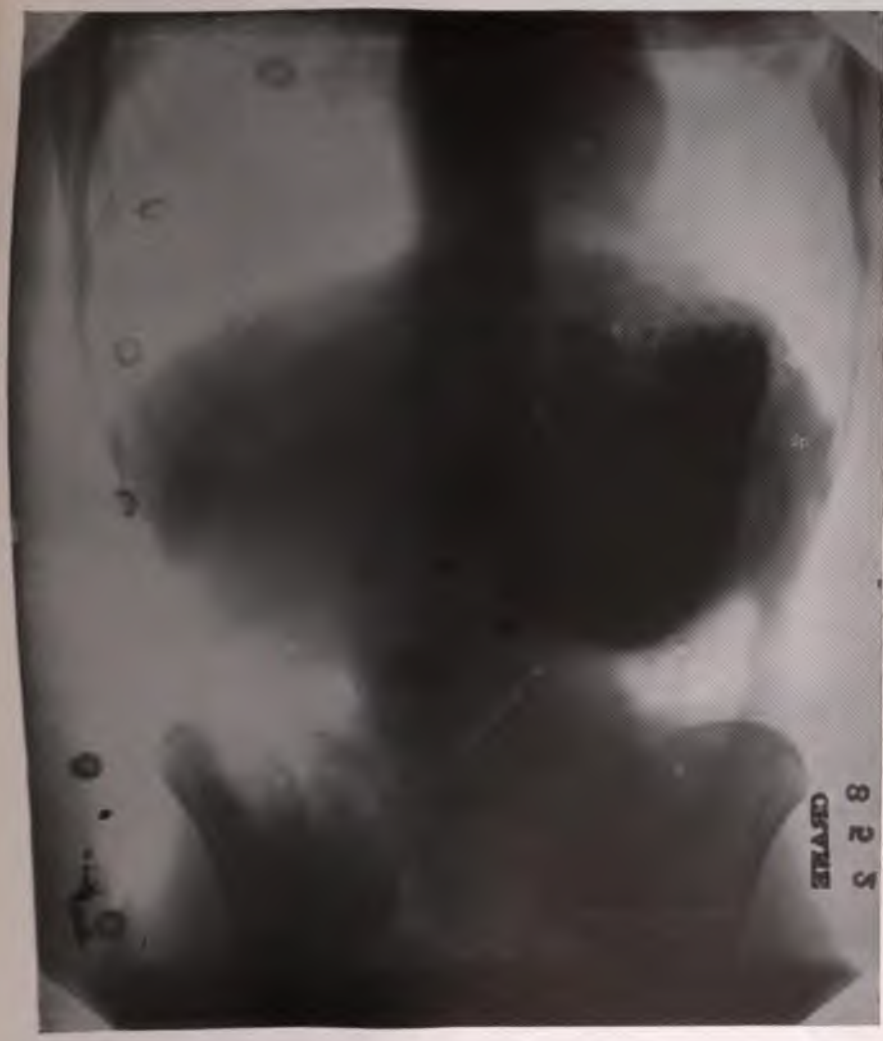
Gastroptosis showing a long attenuated stomach. Rugæ plainly isible. Made with a transformer, exposure three seconds.

PLATE XIV.



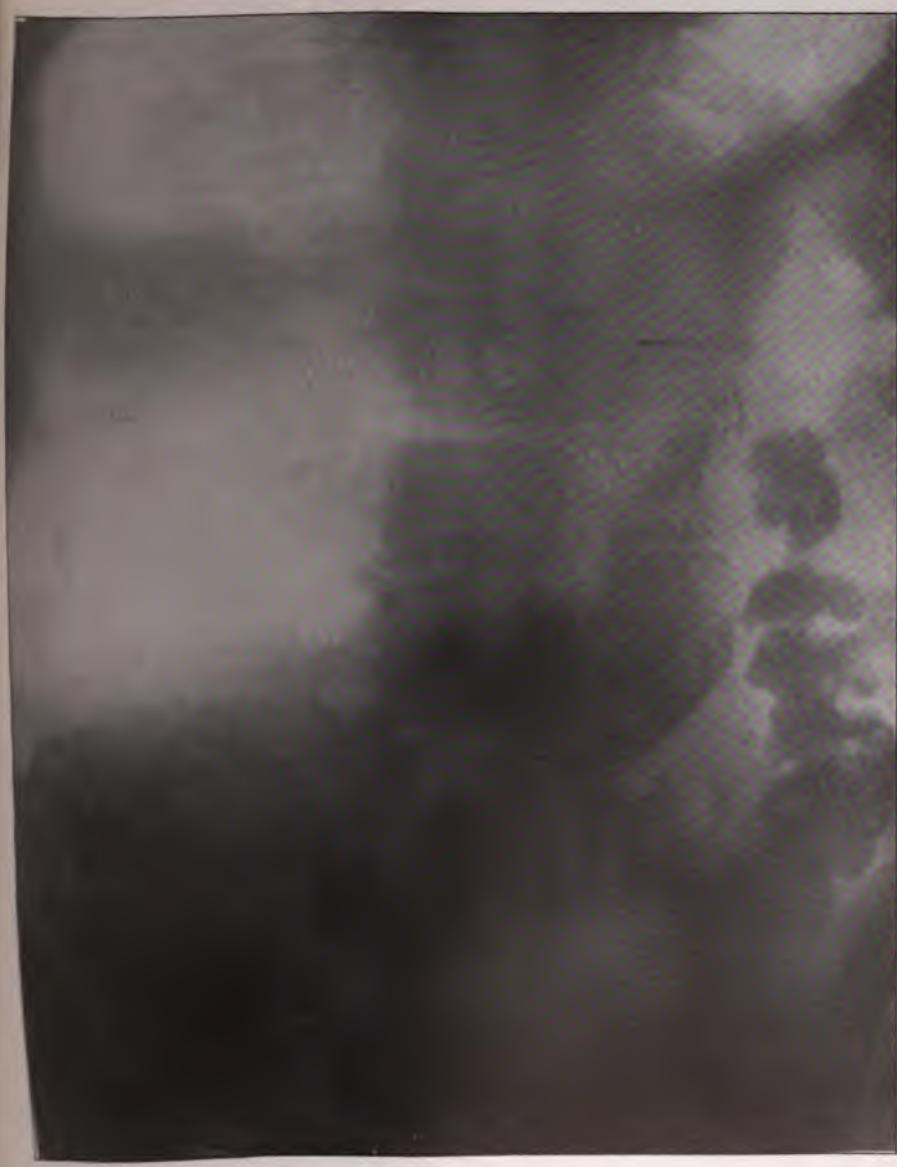
Gastroptosis. Roentgenograph of a private case of gastroptosis in a young woman of twenty-one years of age. The picture shows a long vertical stomach with the typical sharp bend near the pyloric extremity. The two dark circles are of coins at the ensiform and umbilicus. The stomach contained an ounce of bismuth subnitrate in pint of kefir at the time of exposure.

PLATE XV.



Attenuated stomach ("drain trap"). Irregular outline of organ due to peristalsis. *S, S,* Stomach. *F, F,* Fundus. *Co,* Cardiac orifice. *P,* Pylorus. *g, g,* Gas. *D, D, D,* Duodenum. *Sp,* Spleen. *H,* Heart. (Skiagraphed by A. W. Crane, Kalamazoo, Mich.)

PLATE XVI.

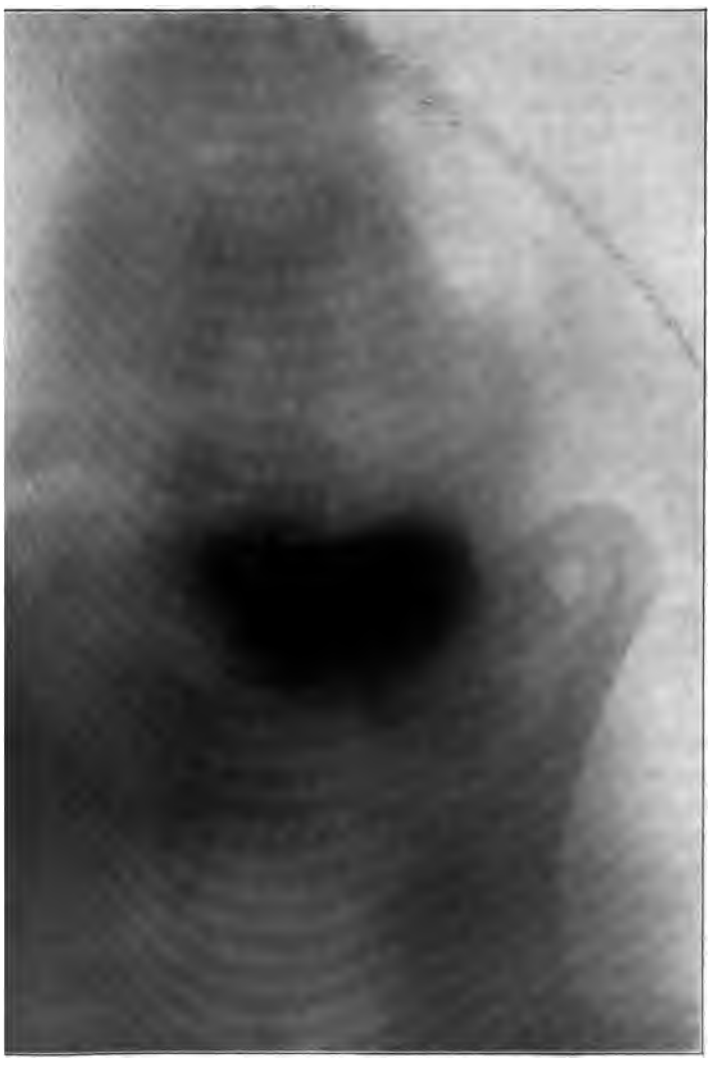


Gastroptosis and coloptosis. Hepatic flexure lying in pelvis, gastric flexure half-way down. S-shaped irregularity of transverse colon. Made with a transformer, exposure three seconds.

PLATE XVII.

Gastroptosis. Long attenuated stomach. Roentgenograph taken with ient in the prone position. Case of Dr. C. S. Raue, Philadelphia.

PLATE XVIII.



roptosis. Same patient as foregoing. Roentgenograph taken in position, showing the greater curvature slightly below the upper he sacro-iliac joint.

from four to six inches, and the mouth gag is inserted on the left side. The assistant is placed on the right side of the patient's head on a stool of appropriate height, as though on a side saddle, his right leg beneath him in the kneeling position, his left foot supported on a stool twenty-six inches lower than the top of the table. His right forearm is passed beneath the patient's neck, supporting it, his right hand grasps the mouth gag, drawing it strongly at or in front of the bregma, bending it backward and exerting a certain degree of upward pressure. The foregoing points having received attention, certain difficulties remain. They lie, however, altogether above or opposite the cricoid cartilage and are surmountable with slight practice. Mikulicz determined one point, namely, that a gastroscope must be rigid.

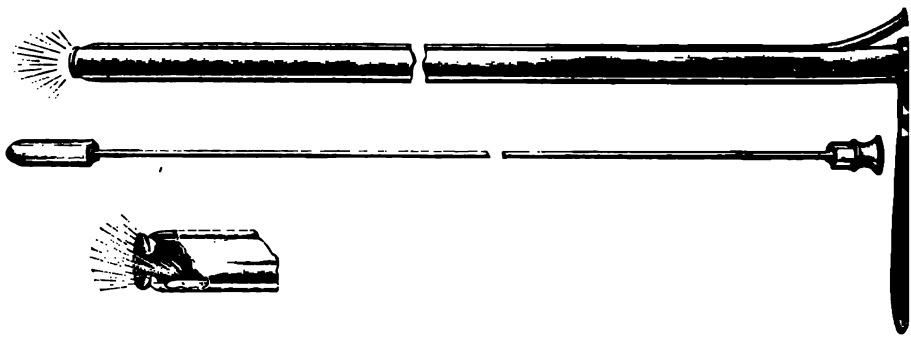
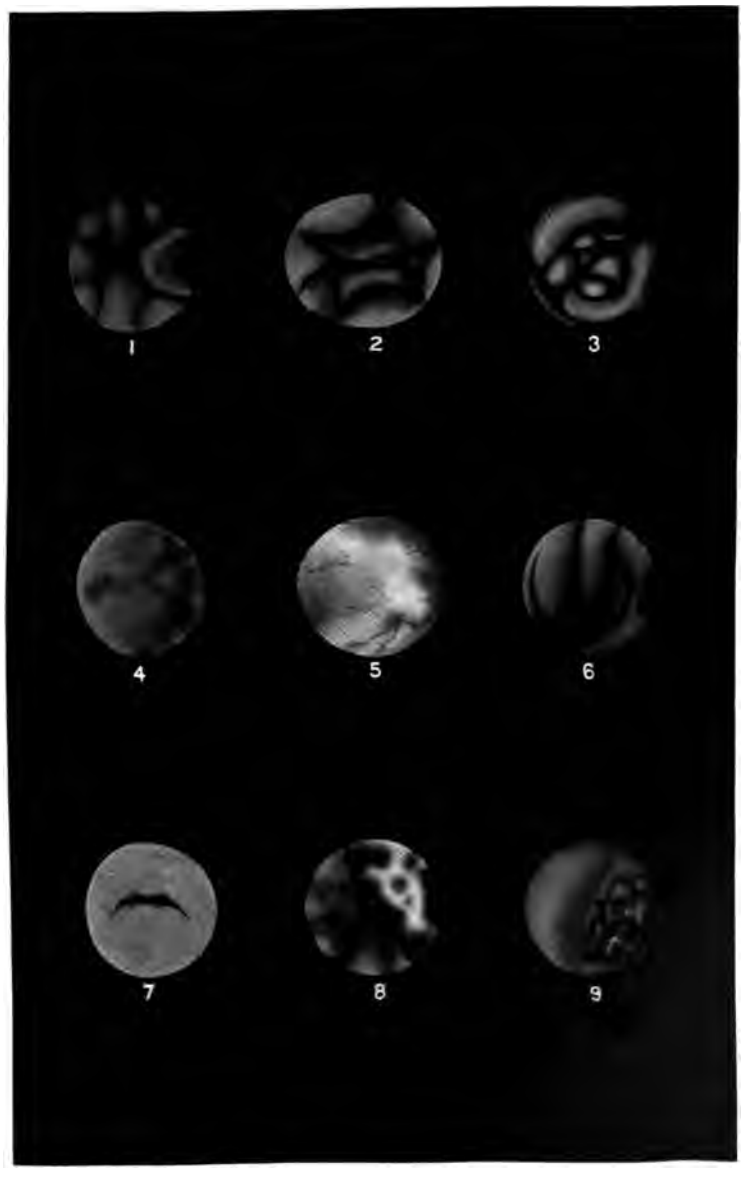


Fig. 26.—Dr. Chevalier Jackson's gastroscope.

Rosenheim went a step further and said that it must not only be rigid but should be straight; now I think we are ready to add four more dicta,—1. Optic apparatus must be abandoned. 2. The tube must be passed by sight. 3. The stomach must be examined in a collapsed state, to permit of mopping, palpation with the instrument, probing, and combined endoscopy and external palpation. 4. General anesthesia is indispensable to prevent contractions of the diaphragm which clamps the tube, rendering exploration impossible."

The instrument with the obturator *in situ* is dipped into warm water, or better thoroughly lubricated with glycerin. The esophagoscope may be introduced without the employment of a general anesthetic, although this is always preferable (the fear instilled in the patient from the looks of the instrument, and the distress incident to its passage makes a general anesthetic almost essential in most instances). Should it not be used, the patient sits on a backed chair

PLATE XIX.



Gastroscopic Views. (Jackson.)

1, Normal stomach. Three centimeters below the cardia. 2, View near the pylorus. 3, Same location, same patient. 4, Chronic gastritis. 5, Cicatrix in stomach. 6, Stomach ulcer on left side of right fold in view. 7, Cicatrix of perforated gastric ulcer. 8, Carcinoma of pylorus. 9, Carcinoma of pylorus.

with head thrown back and face toward the ceiling. The instrument is pushed into the esophagus without exerting any force and introduced the length of the esophagus. The obturator is then withdrawn, the lamp lit, and inspection begins and continues while the tube is being withdrawn. In stomach observations, it should be recalled that the most important regions of the organ for the site of pathological lesions, the pyloric and lesser curvature—are not accessible to vision through the tube, and thus that if nothing abnormal was noted in as much of the gastric mucosa as would be seen that serious disease may still exist in these inaccessible regions. Both instruments should not be used excepting where a diagnosis cannot possibly be made by the other well-known methods, and only when, for existing reasons, a diagnosis is important to be obtained quickly. It should not be used in esophageal or gastric ulcer or phlegmonous gastritis, and it should be recollected that serious stomach disease may exist in the walls, or extra gastric of those areas, exploration of which might not show its presence on the mucosa side. Its field of usefulness is to make or confirm the existence of early malignant disease in the esophagus or stomach (carcinoma and sarcoma), to remove foreign bodies from both organs, and to diagnose and possibly remove papillomata or polyps from the stomach. In my experience, better results in examining the pyloric region are obtained in women than in men; this I believe is due to the fact that in women the vertical stomach is more commonly met with.

Since secretions in the esophagus and stomach are exceedingly difficult to remove through the tube and are disturbing factors in the value of the observations, the use of a full dose of morphine and atropine, or just atropine alone, should be administered hypodermically one or two hours before the observations are begun. A great disturbing factor in the use of these long tubes is the reflex of light in its interior; particularly is this troublesome in the proximal light instruments. When the lamp is at the distal end, the surface of tissue seen is very bright in color and the nearby light in the tube throws a reflex so bright that the whole vision is as of one character, and thus one has some difficulty in keeping the vision centered on the tissue itself. For this reason, I have made a slight modification to the Jackson instrument I employ which consists of having the interior of the distal end oxidized or painted black for a distance of about 15 centimeters. By the existence of this darkened zone a darker circle is seen about the tissue at the end opening separating this from the reflex of light nearer to the eye.

n be obtained in all surgical appliance houses and answer for all ırposes. Such instruments being somewhat too long (60 centieters) to be carried about, which is rarely necessary, Einhorn has ggested the above modification.

References.

[1] Boas: "Diseases of the Stomach," p. 79.

[2] Kelling: 74 Versammlung Deutscher Naturforscher und Aertze in Karlsbad, Weiner Medizinische Wochenschrift, 1902, Nu. 48.

[3] Revidtzev: Berlin. klin. Wochenschrift, 1908, Nov. 15, p. 749.

[4] Bassler: "Extracting Test-meals," New York State Journal of Medicine, June, 1908.

[5] Flade: Münchener Medizin. Wochenschrift, 1901, No. 32.

[6] Boas: "Diseases of the Stomach," p. 104.

[7] Rieder: Münchener Medizin. Wochenschrift, Aug. 30, 1904.

[8] Pfahler: Journal of the American Medical Association, Dec. 21, 1907.

[9] Jackson: Medical Record, April 6, 1907; Journal of the American Medical Association, Oct. 26, 1907.

CHAPTER VI.

Method of Chemical Examination.

MIXED SALIVA.

THE examination of saliva is occasionally indicated and may be of considerable significance. In doing so we take into consideration its quantity, reaction, the amylolytic power of its ferment ptyalin, and the presence of abnormal constituents. The examinations are colorimetric and qualitative in character with standard test solutions of five per cent., the employment of litmus paper, and the microscope for the organic elements. Small sized porcelain dishes (like those supplied in children's paint boxes), or a glass slab backed with white paper are necessary to note the delicate color reactions. The chewing on a piece of india rubber and the collecting of the mouth secretions will usually cause the flow of enough mixed saliva for the examinations.

The quantity of saliva secreted per day is about 1500 grammes. This quantity, however, is subject to great variations even in health. The quantity is markedly increased in a reflex way in a number of gastric disorders, and directly by most all of the inflammatory conditions about the mouth. An increase is frequently noted in pregnancy, in neurotic conditions, bulbar paralysis, and following the administration of mercury, pilocarpine, acids, etc. It is decreased in the febrile conditions, in diabetes, often in nephritis, and in psychic influences in which the salivary decrease may accompany a decrease or absence of function of all of the glandular structures in the gastro-intestinal canal.

The reaction of the saliva is easily and quickly noted by the use of litmus or rosolic acid test paper. The latter is to be preferred since the use of the one paper might answer for both the acid and alkaline reactions. This paper can easily be made by soaking strips of fine filter paper in an alcoholic solution of rosolic acid of such strength as to color the paper a delicate salmon pink when dried. When applied to an alkaline saliva a change of color to a brilliant red is noted according to the degree of alkalinity; but if the saliva be acid (which is rare) a change to a yellow is seen. Since saliva is normally alkaline, and when acid only faintly so, a negative result

with the rosolic acid paper should be followed by the more sensitive to faint acid litmus.

Not much significance can be placed on the reaction, because it varies much under normal conditions, and in different individuals, and may continue normally alkaline in pathological conditions. While an alkaline reaction is the rule, still in disease of the intestinal tract, in febrile diseases, in diabetes, in gastric cancer and in hysteria it may be acid. In late gastric cancer this is also commonly observed, and is then most probably due to the presence of lactic acid in the mouth left from the vomitus. It may be present as an excretion of the salivary glands, or caused by fermentation of micro-organisms present in the mouth. In these latter mouth or dental conditions (caries), the acidity may be due also to the presence of small quantities of oxalic acid.

Important indeed in gastro-intestinal work are the estimations of the diastatic power of the saliva. While hasty eating, insufficient chewing and insalivation would cause to be delivered into the stomach less ptyalin for carbohydrate conversion, and this might cause the development of gastric symptoms; such is only a relative condition (in those instances the ferment examinations of the saliva would show this secretion to be normal) and thus are not considered here. There are conditions of gastric dyspepsia which are apparently directly and specifically due to diminution or absence of the quantity of ptyalin secretion. Such may be seen in the neurotic and psychical conditions, atrophy of the salivary glands (when the entire true salivary secretion and sense of taste in the anterior two-thirds of the tongue are lost); in what, for the want of a better term, may be designated general neurological atrophic disease wherein gastro-enteric, spinal cord, and retinal atrophy are present; in some of the outside medical diseases—such as chronic nephritis, diabetes, Addison's disease, and in the ascitic conditions. Whenever in the non-malignant diseases of the gastro-enteron where the gastro-intestinal secretions are low in quantity or character, it is most desirable to test the amylolytic power of the saliva before the institution of a heavy carbohydrate diet, for if this mouth secretion is also deficient or of poor enzymotic quality it immediately becomes a question as to whether the institution of such a diet would be well borne by the stomach of that individual. This examination is not so often necessary (although still desirable) in states of increased gastric juice secretion where the examination of test-meals shows a poor starch conversion due most probably to the inhibitory effect of the high HCl content on the ptyalin in the stomach.

The ptyalin is fairly resistant to external influences, and is immediate in its effect upon the hydrated starches. Leaving out of consideration the starch examination of the gastric filtrate and considering only the direct examination of the saliva, the simplest test for the presence of the ptyalin and a fair deduction of its quantity may be performed in the following way. About 5 cubic centimeters of saliva are filtered through very fine filter paper and added to a weak solution of hydrated starch in like amounts. The test-tube is shaken, put into a warm chamber for from 5 to 10 minutes, and then examined with one or two drops of plain tincture of iodine or Lugol's solution. The striking of a distinctly blue color shows that too little or no ptyalin at all is present; a red or violet, that it is present in fair amounts (erythrodextrin); no color at all (achroödextrin): or a much lighter reddish color than the above (erythrodextrin and achroödextrin combined) and that the amount is surely normal. A control test may be made with a portion of starch-saliva mixture by means of estimating the presence of maltose sugar by its reduction of Fehling's solution; the latter can be used in the first instance as a qualitative and quantitative test, for if a distinct reduction of the Fehling's is obtained it may be considered that a normal amount of ptyalin is present in that saliva. Care must be exercised that the starch solution is not viscid, that it is cold when added to the saliva, and that the temperature in the chamber is around 37°C.

Qualitative changes in the various chemical constituents of the saliva are common to be noted. They are found to have more significance to other conditions of internal medicine and states of general body than to those of the gastro-intestinal tract alone. Among these, in a general way, may be mentioned the following. The sulphocyanides disappear from the saliva when bile is diverted from the alimentary canal (Fenwick). In severe cases of obstructed jaundice I have found this is so in four of the cases. The return of the sulphocyanides in the saliva during an illness and the diminution of the amounts of ammonia have been considered good omens in grave illness as indicating a returning better state of conditions in the nervous system (Le Roy). Acetone is commonly found in the saliva in toxemias from the intestinal canal. In chronic nephritis there is an increased amount of urea in the saliva. Opium or its alkaloid, no matter how taken, may be detected in the saliva within a few minutes afterward; thus it is a test of value in detecting the cases of morphinism which give gastro-intestinal symptoms of an obscure origin.

Simple tests for the presence of the above mentioned substances are performed as follows:—

Sulphocyanides.—To the side of a large drop of saliva add a drop of slightly acidified solution of ferric chloride; if the sulphocyanides are present in normal quantities there will be a faint pink coloration at the contact area, which afterward spreads throughout the saliva. The color will be a deeper pink and even a red when the sulphocyanides are increased.

Ammonia.—Add a small drop of Nessler's reagent to the center of the drop of saliva; if ammonia be present a reddish-yellow will develop at the site of the drop with a faint pink aura around it.

Acetone.—Add a drop of very faintly red alkaline solution of sodium nitroprusside; if acetone be present a ruby red color is produced which changes to a yellow. Now add an acid (acetic) and boil when a blue or a violet will result.

Urea.—Take 5 cubic centimeters of plain saliva and evaporate over a water bath to about one-quarter, add alcohol, shake well, filter, evaporate to dryness, dissolve residue in distilled water, treat with a drop or two of nitric acid, wait a while, and the characteristic rhombic or hexagonal plates of nitrate of urea will be found.

Opium.—The same test and color reaction as for the sulphocyanides, only subsequently add a drop of corrosive sublimate solution and if the color is due to the sulphocyanides it disappears, but not if iron meconate has been formed at which it remains unchanged. For detecting morphine, a neutral ferri chloride solution is best, or a drop of neutral ferric alum. Both give a dirty green color.

Of the micro-organisms found in the saliva where pathological conditions about the mouth are present, it may be said that in the inflammatory states of the gums and mucous membrane those normally present are found in greatly increased amounts, with leucocytes, slips of necrosed tissue and red blood-cells as common findings. In cases of actinomycosis the ray fungus may occasionally be collected at the gingival margins of the teeth or from the interior of the mouth tumefactions. In children with thrush, and in adults with phthisis, the oïdium albicans are commonly seen. The pus producing organisms are present in ulcerative conditions about the mouth and in tonsillitis. The Löffler bacillus is present in true diphtheria (but may be found in normal mouths), or for weeks after an attack of this disease. A streptobacillus is commonly present in the mouth in scarlatina and glandular fever. The tubercle bacillus is often seen in the saliva of patients who have pulmonary tuberculosis with expectoration, and but rarely in lupus or tuberculosis of the mouth.

VOMITUS.

The examination of the vomitus is of vast importance in the diagnosis of gastro-intestinal affections, and it may be said that the more severe the affection the more valuable are these examinations. In some cases of acute gastritis of the simple dietetic type, in neurotic conditions, and vomiting reflexly from other causes, usually little can be gained, excepting possibly to assist in making a diagnosis in the negative way.

In examining the vomitus note should be made of its appearance, quantity, odor, chemical reaction, microscopical findings, and the presence of abnormal constituents.

Considering such, it should first be stated that the findings of large quantities of undigested food several hours after a meal may be seen in acute gastritis, the neurotic affections, gastroptosis and allied conditions, and in chronic gastritis, particularly the atrophic and cirrhotic forms. In gastric cancer and all severe types of pyloric stenoses vomiting of food remnants taken hours or days before is common (collective vomiting). A form of vomiting not so pronounced as this may be seen in hour-glass contraction, or severe states of myasthenia. It should always be noted whether the food seen is digested, only partly so, or not at all, and which of the different foods have been the best or least digested. When all foods have been well digested, the vomiting is usually neurotic or reflex in nature. The albumins (meats, fish, etc.) are usually found well digested in states of high gastric juice secretion, and the carbohydrates when these are low. In the face of a high acid-enzymotic content in the stomach increased amounts of mucus (gastric or swallowed) will interfere with the albumin conversion, but not so much so with that of the carbohydrates. In instances of an acute onset of vomiting for dietetic reasons, little reliance should be placed on the examination of the vomitus—this also holds good in the more or less chronic gastric cases. The reason of this is that such vomitus usually contains large quantities of undigested foods, no HCl or pepsin, and large quantities of the organic acids from acute cessation of gastric digestion, which cessation, after the obnoxious contents of the stomach have been removed, may quickly disappear with the establishment of more or less normal stomach function and better digestion.

When, however, such vomiting is more or less of a constant feature in a case of stomach disturbance, more reliance can be placed upon the character of the returns, particularly should these continue about the same in character each time. In such instances more or

ess digestion and the presence of HCl are commonly seen. Small amounts of undigested foods are of no significance in any diagnostic way. Vomiting of the stomach contents should be distinguished from regurgitation of undigested foods mixed with mucus and saliva. The latter is present in many forms of stomach affections, and to a more marked degree in stenotic conditions of the esophagus and cardia. Where vomiting from the esophagus exists, the foods will be returned as swallowed, and an admixture with gastric juice absent. A vomit which contains hydrochloric acid is most probably from the stomach, and that containing bile is positively so.

Some significance can be attached to the odor of the vomit. During the height of normal gastric digestion the stomach contents have a slightly acidulous smell—not pronounced or markedly unpleasant. When the vomitus is strongly sour in smell (absence of digestion and presence of fermentation), the organic acids are usually present in easily appreciated amounts. It is of a fecal odor when for any obstructive reason regurgitation of chyme or fecal substances has taken place from the intestines into the stomach.

The taste is that of the food taken a few hours before, or indifferent in nature in acute gastritis, the psychic and neurotic conditions, in a few cases of gastroptosis, or sometimes in vomiting of a reflex nature. It is acid in states of high gastric juice secretion, and bitter in gastric stagnation from any cause or when the vomitus is admixed with bile.

Of the distinct abnormal products that may be found in the stomach and the character of small amounts of vomited matter in different conditions of disease, the following should be mentioned.

Blood.—Small amounts or streaks of blood are commonly noted where severe retching or straining at vomiting exists and these are of no great significance (since in these instances it may come from the pharynx, esophagus, trachea, or mouth). When it is large in quantity and more or less altered in character it is indicative of its collection in the stomach. Such bleeding may be present in cases of ruptured varix of the stomach, bleeding of a large vessel in an ulcer base, from the ulcered surface of a carcinoma, from punctate ulcers, intense hemorrhagic affections of the mucosa, in thoracic aneurisms rupturing into the gullet, in vicarious menstruation, in ulcer of the lower esophagus, and the returning of swallowed blood from the nasal cavity or pharynx. Early in acute gastric ulcer, rather generally in the soft forms and late in the hard forms of gastric cancer, a vomiting is often seen which is quite frequent and small in amounts, consisting mostly of mucus, foods, gastric secretion, and blood. Such

vomiting may be quite reddish in color, although usually it is brownish or green. (See blood tests on page 182.)

Mucus and Saliva.—These are present in most all vomitus, but when observed as the main constituent of the ejecta from the stomach it is most significant of a state of chronic gastritis. The mucus is usually recognizable with the naked eye (glassy appearance), by the microscope, and by its chemical behavior with acetic acid (not dissolved).

Pus.—This, unless large in quantity, is rarely seen by the naked eye, but most easily by the microscope. It is found mixed with the vomitus in cases of phlegmonous gastritis, in ruptured gastric abscess, in infective ulcerated states of the stomach (cancer), in subphrenic abscess, in fistulous states from suppurative pancreatitis, abscess of the liver, small and large intestine, or if swallowed from the air passages, mouth, or gullet, and collected in the stomach. In carcinoma affecting the fundus or lesser curvature, it is, as Strauss[1] has pointed out, a diagnostic matter of much value. In one of my cases of cancer of the lesser curvature, in which the growth did not involve the pylorus, a mucopurulent vomiting from the empty stomach was a rather constant feature.

Bile.—Bile is frequently found in vomited matter whenever the vomiting is severe or frequent. When constantly present in large amounts with pancreatic and intestinal secretions it is usually due to stenotic conditions of the upper portion of the small intestine. Bile itself can usually be recognized by the naked eye, but in doubtful cases tests for the bile constituents may be employed. For these and also tests for pancreatic juices, consult Chapter VII. The vomiting of bile-stained mucus and fluid are commonly seen in migraine, centric and reflex vomiting from the various causes, and in severe types of acute gastritis.

Other abnormal substances occasionally found in the vomitus are particles of mucous membrane or tumors (the detailed examination of which are of great importance in the diagnosis of gastric conditions); fecal substance which can be detected by its odor and the examination of a distilled portion for the presence of indol, phenol, and skatol; intestinal parasites, such as the round worm, segments of tenia, ankylostoma duodenale, trichinæ, hydatid cysts from echinococcus of the liver when these have ruptured into the stomach, and the larvæ and embryo of insects.

METHODS OF EXPRESSING TEST-MEALS.

For the purpose of obtaining definite information of the state of gastric secretion, the dynamic power of the organ, abnormal findings pertaining to the stomach, or perverted states of the conversion of foods, the employment of test-meals is essential. The technique of introduction and the care and the best forms of tubes to employ for this purpose are described in Chapter V. The two methods employed in extracting stomach contents are the aspiration and the expression methods, and since a knowledge of both is desirable in the routine of gastric work they will be considered in some detail.

Aspiration Method.—Measures of assistance in the aspiration of stomach contents comprise the use of a pump (Kussmaul), a stiff rubber sphere, and of a bottle with an exhausting syringe. A length of outside tubing reaching to far below the level of the stomach may,

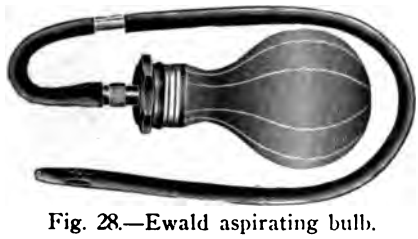


Fig. 28.—Ewald aspirating bulb.

by syphonage, empty the organ; this is practical in the return flow in lavaging, but for obvious reasons is not worthy of consideration in test-meal extraction.

The employment of the Kussmaul pump is much too strenuous a method for obtaining stomach contents. It entails the use of a complicated and difficult to clean mechanical pump, the dangers of which have obviated its use even by the ambulance surgeon in his emergency poison cases; the same holds true with any forms of apparatus that are applied directly on the end of a stomach tube (rubber spheres, syringes). I feel that much of the harm and prevalent opprobrium of suction can be attributed to the employment of the direct suction exerted by their use, for when at work such an apparatus practically incorporates the entire length of stomach tube into part of a syringe the end holes of the nozzle of which play directly upon the gastric mucosa. The danger of harm in the way of detaching particles or sections of mucosa is plain. If an assistant manipulates the ball or syringe there is always danger of a too forcible suction, for usually the slower or less the return, the more energetic

are the efforts. Of course, with the bulb in your own hand one can be more careful, but still it is difficult to regulate its degree of force, and in a rash moment born of discouragement at the poor results in the way of return, one is very liable to send in a charge of air (to free the end holes of the tube or straighten out the kinking of it) followed by a much too forcible draw.

Lastly, suction can be exerted by the employment of a bottle more or less freed from air on the principle of the apparatus recommended by Fürbringer[2] to remove pleural exudates, and which has been modified by different observers since its introduction. Among

Fig. 29.—Author's test-meal bottle. *a*, Stomach-tube with cut-off; this tube is joined, by means of a straight glass tube, to the tubing above, which is fastened to a short bent glass tube which goes through the rubber cork into the neck of the bottle on that side. *b*, Rubber aspirating bulb, tube and cut-off; this bulb mildly exhausts the bottle of air. *c*, Inflow bulb, tubing and cut-off for delivering air into the bottle and stomach. The tubes of both of the bulbs are fastened on a glass Y which had been bent as shown in the illustration.

the first to employ such an apparatus and draw attention to the advantages for aspirating stomach contents was Boas. This observer employs a Woulffian flask, or a one-necked glass flask the stopper of which contains two perforations. Two glass tubes, as wide as possible, are introduced into the openings, one of which connects by means of a rubber tube with the stomach tube, while the other is joined to a Potain syringe or a rubber balloon, which exhausts the air (Boas[3]). My objections to the use of the Potain syringe are, that degrees of exhaustion in the flask are always more or less of a question; the syringe may not work properly, the cork and glass tubes may not fit tight enough so as to maintain a suction force throughout the

course of extraction particularly when the bottle is large in size or the return abundant in quantity; that an assistant is usually necessary in the performance; and that a too strong degree of force may be exerted. For these reasons and because by its use the inflation of the organ is conjointly accomplished at the time of the extraction of the test-meal, I will quote from a recent article of mine in which was advanced a modification of the Boas apparatus. (Bassler.[4])

"The bottle is a simple, heavy, two-necked bottle of 500 cubic centimeters capacity, on which are marked graduations (diamond ink may be used) running from 20 to 260 cubic centimeters; two long marks at the right of 20 to 70 cubic centimeters show the limits of normal returned quantities from an Ewald and Boas meal. In the left rubber stopper is a single bent glass tube connecting by means of a length of tubing, on which is a cut-off, with a straight glass tube that fits directly into the end of the stomach tube. At the beginning of the expression, if the return is easy, quick, and not too distressing to the patient, that completes all there is to the apparatus. It is simply expression into a graduated bottle of small size, the right end of the apparatus being detached and therefore inconspicuous. The right end consists of a Y-shaped tube, bent downward, to which are attached the aspirating bulb (front bulb), and an inflow bulb (rear one) for the purpose of inflating the stomach after the meal has been extracted. This right end can be quickly plugged into the right neck and be brought into use in an instant of time. The extracting limit of the aspirating bulb is about 55 cubic centimeters, thereby making the degree of suction from the bottle from *nil* to only and always a safe and easily regulated degree of force. The attachment of the two bulbs on the one stem does away with the necessity of changing the aspirating bulb around for the purpose of inflation. The bottle and tubes are easily cleaned, the right end never coming into actual contact with the meal. The graduations on the bottle mark the upper meniscus, as the meal is generally turbid.

"It is true that all this means 'apparatus,' and apparatus sometimes suggests to an apprehensive patient a 'pumping out of the stomach.' But in this regard my experience with the bottle has not been discouraging; on the contrary, patients have often expressed words of surprise and pleasure that it was all done so much quicker and with less distress than had been their experience on other occasions when the tube alone had been used, and I have been so well pleased with the employment of it that I feel that I can heartily endorse its use. For it is true that under all conditions, particularly when extracting a test-dinner or when there are obstructing particles of food in the chyme in the stomach, it is decidedly more satisfactory than when depending upon expression alone. With the proper degree of thoughtful manipulation and skill from a bottle like this, a stomach can be emptied quicker and more positively, with less distress to a patient, and surely with no added dangers to the integrity of the gastric mucosa, than by the unassisted simple expression method, and I say this after an ample experience, a close consideration and observation of the subject, and the minute examination of several hundred extracted meals."

As time has run on I have further tested the advantages of the use of this bottle in my office work with that of the simple expression method in my clinic and hospital work and I have definitely come to

the conclusion that, not only is its use much more satisfactory in the ways above mentioned, but that the entire stomach contents can always be gained, and by a means decidedly less liable to cause injury to the mucosa than when the expression method alone is employed.

Simple Expression Method.—This method was introduced by Ewald and Boas[5], and has received, because of its simplicity and absence of apparatus required, universal adoption. To accomplish it necessitates merely the passing of a stomach tube into the stomach through which by abdominal effort the patient ejects the stomach contents. In the plain test breakfast (35 grammes of wheat bread and 400 grammes of water) and under favorable conditions it suffices for routine work. But as a method of extraction it is even more liable of injuring the gastric mucosa than aspiration by means of the intervening bottle, although less so than any directly applied suction apparatus to the tube.

All degrees of success with the use of this method are met with. It may be most satisfactory in the way of emptying the stomach of the test-meal, often only moderately so, and occasionally when much uncontrollable straining exists and kinking the tube in the stomach occurs shutting off the return, or when the normal stomach contents are too viscid to rise through the tube, or the stomach contains particles of food large enough to occlude the tube apertures, it is of no value as a single method. No more discouraging moments exist than come, after the taking of a test-meal and the patient is ready for its extraction, to meet with a poor or negative result in its return. As case after case comes to us, into even the most skilful hands, we meet with this discouragement when depending upon the Ewald and Boas method alone. Of course, if we are satisfied with obtaining less than the entire quantity of chyme present in the stomach, then no more need be said. But surely to do the proper kind of scientific gastric work, a greater quantity of gastric juice than 10 or 20 cubic centimeters is required. Even in the chemical examinations for acidity, not to mention the other important examinations, what can you ordinarily do in the way of accurate laboratory diagnosis with only a few cubic centimeters of unfiltered chyme?—just a paper or Günsburg test for its reaction, a makeshift quantitative estimation of total acidity, a few drops for the starches and maltose, slide or two for the microscope and loops for cultures, and it is all gone. How about the knowledge of the total quantity so necessary for estimating the condition of motility and patency of the pylorus, the amount of incorporated mucus that rendered the chyme too viscid to raise through the tube; the undigested food substances (skins and

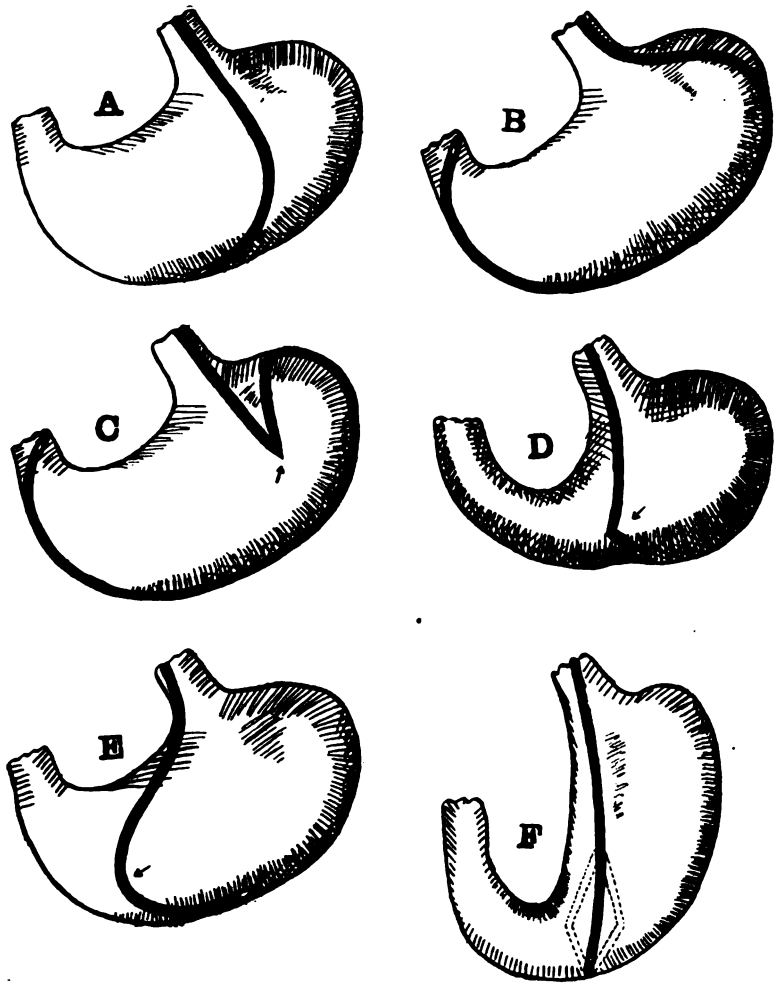


Fig. 30.—Showing the various positions of a stomach-tube within the stomach. Shows the proper position of a tube on the floor for test-meal extraction and age. *B*, The tube pushed in further when the end of the tube crosses to the inning of the lesser curvature as the tube continues upon the entire length of greater curvature and to the fundus. *C*, A sharp kink in the tube if continued ther than *B*, indicated by the arrow. *D*, A possibility when an effort at vomiting made as the tip of the tube engages on the floor, indicated by arrow; such a k, just above the apertures, can take place when the tube is arranging itself as *A*, but in the latter case it quickly corrects itself by the end sliding downward. Shows the tube of *D* continued in the uncompressed stomach, the arrow points the location of an inevitable kink which renders all passage through the tube possible. *F*, Tube in the stomach of ptosis, showing that the tube generally gages directly on the floor at the lowest part of the stomach, after which the ted lines show that it may then bend in either direction.

frame work of vegetables, fascia from meals, etc.) from an early breakfast hours ago, possibly from the evening before, and the particles of which had occluded the eyes of the tube; the proper quantitative and qualitative examination of all the acids (hydrochloric, lactic, butyric and acetic); the thermostat tests with the ferments; the chemical tests for blood, albumoses, peptones, and conversion stages of starch to maltose, and so on, through other examinations as they may suggest themselves as important in a case? No, it is essential that with every test-meal extracted the stomach should be emptied, and for this, as well as for further reasons stated below, a mild degree of steady suction such as is exerted by the author's plan of apparatus is required.

Does a stomach tube always follow the course in the stomach as suggested by Boas?[6] Not always. To prove this to myself, I passed a soft tube half filled with bismuth emulsion (Chapter V) on a number of occasions into stomachs of different shapes, sizes and under different conditions, and by means of the X-rays and fluoroscope proved to myself that this was not always so. As to the course that the tube generally took on the floor of the organ—whether convexity toward the pylorus or fundus—depended upon where the tip of the tube engaged on the floor of the stomach, upon the uplift of the lower region of the organ in the act of vomiting at the contact time, upon the condition of peristalsis at that the contact point, and upon the shape and size of the organ.

To see how a stomach tube can kink under the influence of vomiting explains fully the reason why the return of a test-meal sometimes stops in the middle of a jet during the expression method, and also why at times it does not return readily when the conditions for its doing so are apparently favorable. In my opinion, it is due to the kinking of the tube from the uplift of the stomach in the act of straining necessary to the performance of this method. Further, to note the striking of the floor of the stomach on the tip of the stiff, straight tube as one draws it in or out to seek the level of the stomach contents, causes a rather unpleasant sensation within oneself as to the harm to the mucosa that may be caused by this method. What other explanation than this is there for the occasionally seen blood tinged last few cubic centimeters of a test-meal, and for the more rarely found particles and pieces of glandular layer of the stomach returned by the simple expression method—I mean in cases that are not ulcer, erosions, malignant diseases, congestions of the stomach, etc. Personally, I believe that there is less danger of harm to the stomach by introducing the tube far enough to lay securely along the

floor of the organ, not permitting or encouraging the patient to strain, and then aspirate the contents by some gentle suction method.

In practicing the simple expression method the tube is introduced to the mark noting its position in the stomach, after which the patient is asked to strain as if at stool. The tube is withdrawn or introduced to new levels if the return does not immediately occur, and this is slowly practiced until the flow takes place, at which point it is maintained during several efforts of the patient, after which (when no

Fig. 31.—A small particle of gastric mucosa removed from a stomach during the extraction of a test-meal by the expression method. × about 50 diameters.

more flow occurs) a new level is sought. One should be careful to manipulate the tube in a slow and steady way, remembering that no flow can take place from it excepting during the straining times. In employing this method one should not be hasty in withdrawing the tube when no more return is accomplished, because often when one would suppose that no more contents are present in the stomach, a flow is again established—possibly even greater in amounts than had before been obtained. At the end of the performance, the outer end of the tube is tightly pinched (so that in its withdrawal its contents do not flow into the patient's mouth or soil his garments), and quickly withdrawn by a single sweep of the arm forward and upward. In

the aspiration method the tube is generally free from contents at the time of its withdrawal.

To a practical extent, the first introduction of a stomach tube is rapid and comfortable, and the results in the way of test-meal extraction satisfactory according to the degree of technical skill of the physician, his ingenuity in disarming the apprehension of his patient, and the response of the patient in following his direction. When a test-meal has been prescribed (unless the specific question is asked, which is seldom), it is best to make no mention or suggestion of its removal at the time. "When you return I will test the digestive power of your stomach," or statements of that sort are generally all that are necessary to close the visit preceding its performance; for often, only the mention of the word "stomach-tube" harbors up in the uninitiated mind the horrors of the Kussmaul pump and other strained and unfavorably influencing apprehensions, and such, in nervously inclined individuals laboring with fear and anxiety while the meal is in the stomach, may markedly affect the regular running secretory state of gastric secretion, or from dread, keep them away altogether.

If a patient is present who is accustomed to the passing of the tube it may be wise to demonstrate its introduction and harmlessness to the new patient. If not, keep the tube out of sight until the patient is seated and properly protected by a rubber apron which buttons high around the neck and covers the knees. A reckless sang-froid manner on the one hand, and an unwise degree of fear and hesitancy on the other on the part of the attendant are both unfortunate demeanors. Usually, at the time of the extraction the less said the better, and an easy, quiet, confident mien, with everything on hand, and a few words telling the patient to swallow when you ask him to, are all that are necessary. The tube should be quickly introduced to the laryngo-pharyngeal junction, the patient firmly asked to swallow and when this is done, the tube is pushed with short quick strokes (one hand after the other) into the stomach, at which time the patient is commanded to breathe deeply so that he will note that breathing is possible. It is always advisable to have a closed cut-off near the outer end of the tube so as to prevent loss of some of the meal and the soiling of the patient's clothing and the floor. When the tube is *in situ*, such words as "you have done nicely"—"the worst part is over," or some encouraging remark pertaining to his illness is often diverting.

From now on, success in the procedure of the extraction of the meal is usually enhanced if the patient's attention can be fixed on

something. I have tried Boas' advice to compel the patient to keep looking into my eyes, as well as other suggested plans, but have discarded them all as useless. It must be remembered that unless the patient is one of the tube-broken, resigned, or very confident type, the only thing in his mind's eye is the length of tubing within him, the attendant distress, uncontrollable gagging and retching it causes. In the simple expression method to have the patient hold a receiving bottle in the left hand and caution him to observe that the end of the tube remains in the neck, and occasionally ask him to raise or lower the bottle and so on as you direct, is of value. With the use of the aspirating method by means of the bottle, the manipulation necessary usually sufficiently detracts his attention away from the discomfort of the tube. At the desirable moment, the cut-off is opened and the patient directed to strain for the first time, or the suction begun, which, by the use of the author's bottle, usually causes a flow of the meal after four or five pressures of the bulb, and the stomach emptied when about as many more are delivered at intervals as may be necessary to maintain a slight vacuum within the bottle.

DIRECT EXAMINATION OF THE GASTRIC SECRETION BY MEANS OF TEST-MEALS, AND THE VARIOUS FORMS OF SAME.

For the purpose of diagnosing gastric conditions the best stimulant to employ to awaken the functions of the organ is that of foods. By their use a natural impulse is given to digestion, and when these foods are of known substances and definite in amounts, comparisons can be made with the normal, and, as these may differ from them, diagnoses are possible. For this purpose, test-meals, which are extracted at intervals of time after their ingestion are employed, and these possess marked advantages over other forms of gastric stimulation, such as thermal, chemical, or electrical measures.

Test Breakfast of Ewald and Boas.—This answers the purpose for most of the simple forms of gastric disturbance in the way of noting changes in secretion and to a less extent in motility. It is the commonly used first measure in the routine of cases, and answers the purpose in the majority of cases seen. It is a fluid form of meal, easily taken and extracted, and usually borne without distress in the great majority of instances. It consists of the eating of a roll (water roll), or two slices of bread (white), weighing about 35 grammes, and the drinking of one and two-thirds tumblerfuls of water, or two cups

of tea without milk. This is taken in the morning on a fasting stomach, and is extracted at the height of its ingestion which is about one hour afterward. Observing that tea instead of water was commonly being used, I recently took a series of cases having normal gastric secretions and tried both fluids to note if there was any difference in the way of gastric stimulation between the two. The figures in twenty-seven test-meals from eleven individuals showed that when tea was used the HCl secretion ran from 5 to 9 per cent. higher than when water was used. I therefore argue against the use of tea, and favor water as giving a more accurate indication of the gastric secretion.

The range of normal amount of return is between 20 and 70 cubic centimeters. Increased amounts above 70 cubic centimeters are just as significant of gastric disturbance as 20 cubic centimeters or less—these amounts of course, assume that the stomach had been emptied at the time of extraction. Increased amounts are usually seen in conditions where there is an increased secretion of gastric juice from any cause, when in stagnant conditions contents had been present in the stomach before the meal had been taken, in hypomotility, and in spasmed and stenotic states of the pylorus. Among such conditions may be mentioned marked hyperchlorhydria and gastrosucchorrea, in primary myasthenias, in pyloric stenoses both benign and malignant, in asthenic states of the musculature for reflex or direct neurotic or nutritional reasons, and in pylorospasm, and so on. Low amounts of return are seen in hypermotility for local or constitutional reasons, asthenic disturbance in the normal pyloric reflex, and in more or less constantly relaxed states of the pylorus itself.

A card or slip of paper printed like the following, can be given to the patient and is of assistance in insuring that the necessary directions be definitely carried out.

> On ..... eat light breakfast, taking no meat or fruit. Do not eat or drink anything or take medicine between breakfast and time of test-meal.
>
> TEST-MEAL.
>
> At ..... sharp eat one roll or two slices of bread (no butter, and drink a full glass and a half of water. After this come promptly to the doctor.

Test Dinner of Leube-Riegel.—The so called "mixed meal" consists of a plate of beef broth (about 400 cubic centimeters), a large portion of meat (preferably beef about 150 grammes), purée or mashed potatoes (50 grammes), and a roll of wheat bread. The time for its removal is three or four hours after injection, when it is exam-

ined as to its chemical nature, and particularly as to the amounts and condition of the foods in the way of their extent of digestion.

The use of this meal is of great importance in the accurate diagnosing of stomach conditions—even more so than the test breakfast. This is so because of the character of the meal, and the fact that meat takes a longer time to leave the stomach than only the wheat bread of the Ewald meal. Taking as standards for estimations, we consider that the simple test breakfast should leave a normal stomach in about two hours, and that, because of the addition of the potatoes, the quantity of carbohydrate in the mixed meal is about doubled and that this might delay its total exit to a slight extent (although usually not too much practical extent beyond two hours when this quantity of carbohydrate is taken alone). A plate of beef broth should have left a normal stomach in about three hours, and that the meat itself should have left in from three to four hours' time (Penzoldt's observations taken).

We now additionally consider the mixed character of the meal on the basis that, because of the delaying presence of the meat on the carbohydrate constituent, a longer time in the exit of all takes place—a stomach in the process of digestion empties a mixed chyme and not just one food constituent and then another as these may be ready for intestinal digestion. Therefore, because of this, and the stratification which occurs with this meal, the carbohydrates are always found present in more or less states of conversion to the very end of the exit of all, which, in the normal stomach can be considered as surely five hours. A word of caution should here be given in assuming the existence of pathological conditions when at five or six hours afterward small quantities of foods are extracted, for while the great bulk of the meal is gone, tarrying remnants of food may exist even in the perfectly normal stomach up to the sixth and even the seventh hour of time.

If at the sixth, seventh, eighth, and so on, hour of extraction after the taking of a mixed meal, considerable quantities of the meal constituents are obtained from a stomach, the existence of the following conditions should be considered, namely—pyloric obstruction, states of atony (and both together), a more or less low state of digestive disturbance from degrees of chronic gastritis accompanied with low stomach function, and the existence of neurotic conditions of a depressing type affecting the entire motility of the organ. It must be evident that should the meat taken be of the tough variety of beef, or if swallowed in large particles, a delay in its disintegration would take place in the stomach. For these reasons, and because particles

of such undigested meat would obstruct the tube and seriously interfere with the emptying of the organ, the author advises that chopped meat be used in the mixed meals. After many examinations of mixed meals I have come to believe that when the chopped meat had been taken and a considerable quantity of return of it is obtained at the six, seven, or eight-hour interval, that case should always be looked upon in a serious light.

It is evident that a meal having the proteids constituent of the quality and amount (above the test breakfast) that the mixed meal has, would stimulate a greater flow of gastric juice. Thus it is, that the total chlorine content of them is usually above that present in the roll and water meal, although this may not be manifested in the amounts of free hydrochloric acid (because the hydrochloric acid is combined with the excess protein—combined HCl). It therefore is plain that in an average way the mixed meal is not as useful in diagnosing states of increased gastric juice secretion as is the simple. On the other hand, when the secreting power of the stomach is low or absent to the simple meal, the employment of the mixed meal may be of much service before diagnosing late atrophic gastritis, nervous achylia, or malignant disease—this is a very important fact. My attention was first drawn to this several years ago when achylic conditions were reported so generally in medicine, and following this to the many cases of "achylia gastrica"—the name of a symptom by the way—that were reported to exist by many clinicians. While this is hardly the place to enter into that subject in detail, the significant facts gleaned by the use of different test-meals, and the examinations of them in close detail, would permit of the following statements.

A stomach may respond in normal amounts of acid secretion to a mixed meal, and not at all, or only to a very slight extent to the simple; such small amounts of acid then always being in the combined form.

Many of the author's cases which were sent to him as achylias, showed more or less degree of hydrochloric acid secretion in both meals, and particularly the mixed when these were examined by the Hayem-Winter method, which, it may be added, is liable to give a too low total acid result rather than a normal or too high.

When, with the simple meal the hydrochlororic acid content is absent, the examination of the secretion stimulated by the mixed one should always be performed. In doing this, the mixed meal should be prepared by the physician in double quantities, and after careful weighing of the whole, one half of it should be given, and the other

half run as a control in the comparative chlorine estimations to the extracted test-meal.

The Lactic-acid-free Meal of Boas.—Since all breads, rolls, etc., contain more or less milk, for the purpose of testing for lactic acid that is generated in the stomach the non-lacteal test-meal of Boas answers admirably and is deserving of more general use. While the presence of lactic acid in test-meals is indicative only of gastric stagnation and low or absent secretion, and not at all primarily of cancer unless the growth has in a secondary sense caused these conditions, still, the generation of lactic acid in the stomach is of much significance particularly when the suggested lactic acid free meal is employed in the examinations. Among such conditions may be mentioned, in addition to cancer of the pyloric region and pylorus itself, the various other causes of pyloric stenoses such as the contraction of an ulcer cicatrix, chronic ulcer with much organization of fibrous tissue, hypertrophic stenosis, the benign pedunculated growths of the glandularis, perigastric bands, pressure on the pyloric region by extra-gastric formations, well marked chronic gastritis, etc.

The test-meal consists of about 200 cubic centimeters (7 oz.) of thin, well-cooked oatmeal porridge, which is prepared and served without milk, cream, or sugar, and is extracted in one hour after its ingestion. It is preferable to wash the stomach the evening before, and not to allow the taking of milk or milk-containing foods for at least 24 hours before its extraction.

In the past, a number of other forms of test-meals have been advanced by different observers. Among such may be mentioned those of Germain Sée, Klemperer, Jaworski, Sahli, and others. Collectively they present no advantages over the ones here included, and thus have not received extensive application.

Another form of examination by extraction of stomach food contents to diagnose pyloric obstruction from any cause (particularly its high degree seen in malignancy) should be mentioned. It is the generally employed procedure of advising the patient to eat a full meal in the early evening and the washing out of his stomach the following morning—about ten or twelve hours afterward. Should the patient not have vomited during the night, and food remnants be found in the morning stomach, *bona fide* pyloric stenoses can almost invariably be diagnosed. A simplification of this (used by Mayo), and one which I can heartily indorse as of much value, is the eating of several raisins in the late evening and noting if their skins or seeds are obtained in the morning lavage water. After a number of observations with this method in cases of pyloric stenoses that are not

marked in extent, I am convinced that it is desirable to add to the raisins several stewed prunes—or dried prunes eaten raw—simply to increase the bulk and to do this by not employing too many raisins. See author's sieving pail on page 380. While in this test the obtaining of vegetable skins are of much significance, a negative result does not always mean that no stenosis exists. A less complete degree of stenosis, particularly in the pyloric region and not directly at the exit, may give positive results with the six, seven, or eight-hour extraction of the mixed meal, but a negative finding with the Mayo method. The matter is entirely one of degree of stenosis in which it may be said that the nearer to the pylorus itself the stenosis is, the more accurate are the results by both methods, and the less the degree of stenosis or the further away from the pylorus it is situated, the better it is from the mixed meal and the less so from the Mayo method.

Since the noting of the dynamic power of the stomach is of even more importance than the status of secretion, I have recently in all cases used a combination of Mayo's suggestion with the Ewald-Boas meal instead of just the simple meal alone. That is, I use the raisins or prunes as one would the mixed meal in noting how long the stomach took to empty itself by giving the first as many hours before the extraction of the simple meal as desired. Ordinarily, a breakfast as noted below would have left the normal stomach in five hours' time (although a few small remnants may be left), and thus when the simple test-meal is extracted the skins would not be noted in it. The early meal may be timed before the extraction of the test-meal, five, six, seven and so on, hours. Thus, a fair idea of motility may be gained with that of secretion by the examination of the return, and only one test-meal extraction be necessary for both. However, when much returned skins are observed, the employment of the Leube-Riegel may be necessary or desirable.

> On.....at.....o'clock sharp eat a breakfast consisting of six stewed prunes or ten raw raisins, a little cereal, and tea or coffee. Do not eat or drink anything or take medicine between breakfast and the following:—
>
> At.....o'clock sharp, eat one roll or two slices of white bread (no butter) and drink a tumbler and a half of water. After this, come to the doctor, showing this card to the nurse at the door on entering.

Attention should be paid to the time these test-meal extractions are made; the morning being by far the more preferable. Quite

naturally a meal extracted late in the day, after other meals have been taken, or when the patient had been physically or nervously exhausted may give much lower readings in the secretory and motor way than those taken after the night's rest.

In many instances more than one extraction of test-meals is necessary for the diagnosis or to watch the course of treatment, and when suspicious findings are obtained from the simple meal, the employment of different meals may be necessary to complete the diagnosis in the first instance.

METHODS OF TESTING THE GASTRIC SECRETION OTHER THAN BY MEANS OF TEST-MEALS.

Because of the fact that the extraction of test-meals necessitates the passage of a stomach tube, observers, by various means, have devised more simple and less distressing measures to estimate the status of gastric secretion and motility. After a rather extensive experience with most of them, and considering them as a class, it may be said that, while their employment may answer to fair practical purpose in single instances, the results obtained by their use in a general way are far from as satisfactory as by the employment of the test-meals themselves; but when the use of the stomach tube is contra-indicated they may be of some purpose. In the following description of these methods the author will delineate their limitations and the doubts which have assailed him from their use in diagnosing gastric conditions.

Methods of Günzburg and Sahli. (Desmoid Reaction).—On the principle that a stomach which is secreting gastric juice would digest catgut, contrivances tied with this substance and containing some chemical compound which, when freed, would enter the general circulation and manifest its presence in intervals of time in the urine or saliva, the above mentioned methods have been devised and have received very general use. Saito[7] has shown that Günzburg and Sahli were led into error in believing, because the pancreatic juice failed to digest catgut, that when the contained chemical substances of these packages were found in the urine acid gastric juice must have liberated them. These observers did not take into consideration the physiological fact that the pancreatic juice itself is practically an inert secretion in the proteolytic way unless it had been activated by the intestinal secretion, and that, therefore, in the human body catgut can be and is digested in the small intestine even when it had passed

some moments in the stomach, it is withdrawn and its contents examined in a modified form of the usual way. Results from its employment are far from satisfactory. The reasons for this are that the fingers must be introduced into the patient's mouth, that swallowing of the capsule is a difficult matter with many individuals (hardly less distressing than the passing of a stomach tube), and that more or less saliva and esophageal mucus usually get into the capsule before the stomach is reached (these are alkaline and interfere with the acid estimation of the return), that even under favorable conditions the capsule often comes up empty or with too little gastric contents for examinations of much diagnostic value, and that particles of mucous membrane, detached by the open shoulder of the capsule in the withdrawal of the bucket are not uncommon findings within the capsule. In my opinion, these are not as safe to use as a stomach-tube; still, in instances where the employment of the tube is contra-indicated or not advisable (because of the straining incident to the tube *in situ*) or when patients refuse its introduction, they may be of use to gain some information of the chemistry of the stomach.

All of the chemical ways for testing the motor or resorptive power of the stomach, such as the Salol Test in the first, and the Potassium Iodide in the second, are too inaccurate for practical utility. The Leube method of testing the motor power on the other hand is of much service and is the most convenient for the purpose. It consists briefly of washing the stomach with 1000 cubic centimeters of water six hours after the Riegel meal, and noting the presence and quantity of food returned. As was mentioned before, slight traces of food are often found in the return from normal stomachs, but when these are present in considerable amounts motor or obstructive conditions usually exist.

EXAMINATION OF CONTENTS OBTAINED FROM THE FASTING STOMACH.

Second in importance to the test-meal method of diagnosis is the examination of the contents of the fasting stomach. In fact, in the diagnosis of marked obstructive states of the pyloric region and pylorus itself, the existence of a primary atrophying gastritis in which the glandulature cells are still being shed, and in the more or less continuous secretion of gastric juice (gastrosuccorrhea), these examinations have a priority of importance. Added to these may be mentioned the diagnostic significance of large mucous contents found in many morning stomachs in chronic gastritis—particularly of the

[illegible]

[illegible] ments.

Remnants of Food.—[illegible] ding of large quantities [illegible] is a sure sign [illegible] of primary [illegible] empty even when the [illegible] differentiation of much practical [illegible] wisely empty and the same is true [illegible] the stomach. Very slight amounts [illegible] significance. The method of [illegible] lavage with plain water.

Gastric Tubule Cells.—In [illegible] has progressed to end [illegible] after an achylous condition [illegible] can often be found. [illegible] is preferable, either the empty organ [illegible] of small quantities previously [illegible] and the returned water examined [illegible] desirable as the former because [illegible] with in which the cells are to be found [illegible] author and the process of staining [illegible] XIX, page 487. In states of [illegible] where the mucus content is low [illegible] small numbers (Chapters XX and [illegible] found generally in all test-meals and fasting stomachs they are swallowed from the mouth, [illegible] significance. Ciliated columnar cells may be swallowed in mucus from the postnares or trachea and are of no significance excepting possibly in disease of these areas. Free nuclei from digested cells are common findings.

Gastric Juice.—The passage of a tube into the stomach often excites a flow of small quantities of gastric juice. When this quantity is increased, as it may be up to 100 cubic centimeters, an anomaly of secretion exists, such as is commonly observed in gastrosuccor

rhea and gastric ulcer. In these examinations the empty stomach is aspirated.

Mucus and Saliva.—These are commonly found in the fasting stomach, and are of no significance—excepting in alcoholic gastritis when large quantities of mucus may be obtained. In inflammatory conditions about the mouth and throat, quantities of mucus and saliva may be swallowed and found in the stomach. Mucus is readily recognized by its viscid character and appearance under the microscope, and saliva by its converting action on hydrated starch. These are obtained by dry aspiration, or after saline installation.

Bile and Intestinal Juice.—It is well known that under certain conditions bile may find its way into the stomach. When this occurs its bilirubin is converted into biliverdin and the bile manifests itself yellow or green in color. When it is present in amounts, more or less intestinal and pancreatic juice usually accompanies it giving an alkaline reaction to the return; the latter depends upon whether gastric juice is also present and to what amounts. In my observations, bile is a not uncommon finding in the fasting normal stomach, although not so much so as when severe gastric or general neurotic disturbances exist. Its presence, therefore, should not be made too much of in the local diagnostic way. When present, the pancreatic or true intestinal juices are rarely found in the amounts that the bile is, and when the latter is very small in amount, not at all. In obstructive states of the intestine the presence of large amounts of bile, pancreatic juice, and succus entericus is often the first objective symptom of the condition. To obtain these the dry expression or after instillation is employed. Late or in complete states of intestinal stenosis a light-brownish fluid with a mildly fecal odor can be obtained by washing the stomach, and this is succeeded by a darker fluid which has a stronger fecal odor.

Blood.—When that possible to be caused by the passing of the tube can be excluded, blood in the empty stomach is always of significance. The blood caused by the tube is usually but very small in amount and seen in streaks and bright red. Blood which is more or less changed, or thoroughly mixed with the contents obtained is usually from the stomach itself (swallowed form excepted). Blood here is found under the following conditions: gastric ulcer and cancer; rupture of congested or varicose veins; late in diseases of the heart, liver, lungs, etc.; and in menstruation or the blood dyscrasias. Its presence can usually be detected by the color, or the chemical tests (the occult form only in the latter way). Dry aspiration may be practiced, although aspiration after instillation is safer and more

satisfactory. These examinations should never be performed when hematemesis is present, or the aspiration should be stopped as soon as the return manifests its presence. Leucocytes are also present with the red blood-cells.

Pus.—This obtained from the fasting stomach is of great significance in the early diagnosis of cancer and chronic ulcer. It is also present in phlegmonous gastritis, and is of much value in making a diagnosis of this rather difficult to diagnose affection. It is indicative of ulceration or infection, and is best obtained by expression after instillation, centrifuging the return and examining the sediment by means of the microscope.

Other Findings.—Desquamated fragments of gastric mucosa and particles of tumor tissue are rarely observed, but should always be searched for and examined when seen. Yeast-cells and sarcinæ may be seen, and when yeast is present in large amounts the mucus spirals are often present. Other types of mould fungus may be seen. Among these are those described by Einhorn.[8]

References.

[1] Strauss: Berliner klinische Wochenschrift, 1899, p. 870.

[2] Furbringer: Berliner klinische Wochenschrift, 1888, Nu. 13, S. 254.

[3] Boas: "Diseases of the Stomach," p. 138.

[4] Bassler: "Extracting Test-meals," New York State Journal of Medicine, June, 1908. (This apparatus can be purchased from Eimer and Amend, New York City.)

[5] Ewald und Boas: Virchow's Archiv, 1885, Bd. 101, S. 330.

[6] Boas: Centralbl. f. innere Medizin., 1896; and "Diseases of the Stomach," p. 98.

[7] Saito: Berliner klinische Wochenschrift, 1906, Nu. 40.

[8] Einhorn: Medical Record, June 16, 1900; and "Diseases of the Stomach," p. 100.

CHAPTER VII.

Examination of Gastric Contents.

Of essential value in the diagnosing of gastric affections is a working knowledge of laboratory technique, and the necessary apparatus, staining reagents, solutions, and so on to conduct same. In engaging in this, as well as all clinical diagnosis work, the fitting up of a working laboratory is liable to error in one of two ways. Either the laboratory is too limited in appointment for well-rounded work, or a great expense had been engaged in to make it complete and it is overburdened with unnecessary fittings. While the latter is hardly a fault, for those beginning a laboratory for the first time the high cost of laboratory equipment is often a factor that deters one from engaging in this most necessary part of medicine; for a physician without a practical laboratory at his back is almost as badly handicapped as is a far-sighted person without his glasses. To do gastro-intestinal work properly, in addition to those things suggested in the following pages for gastric analysis, must be added the means to carry out examinations of feces, blood, urine, sputum, and section examinations of tissue specimens. The latter entails considerable extra expense and time in the examinations, and the relatively few specimens obtained in the routine of work might make it desirable for such to be examined in the hospital or by others skilled in making these. In such instances, however, it is always wise to re-examine the section yourself so as to be convinced that the pathological report regarding it is correct.

MACROSCOPIC EXAMINATION.

The first step in the examination of test-meals is the appearance, quantity, and odor. It is surprising how, after a short experience in this direction, one can fairly accurately diagnose many of the gastric disorders by the suggestive appearances that extracted meals present. Still, too much reliance should not be placed upon these macroscopic observations alone, and thus they should always be followed by the more truth-telling chemical and microscopic methods.

An Ewald test-meal from a normal stomach may be described as a dirty whitish-yellow color, the particles in a good state of sub-ision so that its gross appearance is that of well-cooked gruel very fluid consistency, from about 20 to 70 cubic centimeters in ount, and of a slightly acidulous, musty bread smell. The bread roll crusts usually show darker and larger particles than the body the carbohydrate constituent. The stomach contents from a Riegel al extracted from a normal stomach at the third or fourth hour terval is usually smaller in amount, somewhat more viscid than the ove, a trifle darker in color, and of about the same odor as the simple al or no distinct odor at all.

In clinical work, a meal which corresponds with the above findings chlorhydria) may be seen in normal stomachs, in gastric neuroses, a few cases of chronic gastritis associated with atony, in the post-er irritative conditions, in benign growths of the cavity of the gan, and in very early malignant disease.

In states of excess of gastric secretion the total return is usually her, running between 70 to 120 cubic centimeters in hyperchlor-dria, and considerably over this in true gastrosuccorrhea. In diag-sing states of increased gastric secretion the filtrate obtained from e test-meal serves as a better standard of measurement than the al return. Taking filtrates having the same proportion of HCl ntent (30° to 60°), it has been my custom to consider from 20 to 50 bic centimeters as normal, from 50 to 100 cubic centimeters as a etetic increase (hyperchlorhydria), and above 100 cubic centimeters suggestive of a more or less continuous secretion (gastrosuccor-ea). The subject has to do with the total HCl in the quantity of trate obtained, and it must be plain that a filtrate of 50 cubic cen-meters with a total HCl of 30° may be normal, while over 100 cubic ntimeters of filtrate with the same degree of total HCl may be an cess secretion. Therefore it is, that the author advises reckoning e HCl content in the total filtrate, rather than decreeing states of cess or diminution of secretion on the acidity of a small amount of e filtrate obtained, and thus it is that he gives the above standards the estimations of same. The gross appearance of a simple meal in cess secretions (gastritis acida not included) is larger in amount of tal return, and the bread substance is not as finely divided or mogeneous as in the normal. The increase of acidulous odor cannot depended upon in diagnosis, since quite a bland and bread-like ell may be present and high acidity exist. When hypermotility is esent with excess secretion, the return would be small in amount but e coarse appearance of the bread is not changed.

In low states of secretion (hypochlorhydria), the amount, odor and appearance of the test-meal are not much changed from the normal, and in fact it is as these are so and the filtrate gives a low total HCl reading (under 30°) and regurgitation of intestinal juice can be excluded, that such states can be diagnosed. Here again, the total filtrate should be the standard of consideration.

In the absence of gastric secretion (anachlorhydria, atrophic gastritis, achylia) when but little or no gastric mucus is present, the test-meal usually shows definite changes. The return is generally large in amount and bread quickly separates from the meal to the bottom, leaving a supernatant fluid which is clear as water; thus, it resembles bread, water, and saliva which had stood for an hour. Such meals then are very fluid, in which the carbohydrate content, when sufficient saliva had been swallowed, are well digested (excepting usually the crust). In fact, the best evidence of gastric carbohydrate conversion is seen in these meals, providing the achylia is not due to malignant disease. In the latter, conversion is not well advanced (probably due to the excess organic acids in these stomachs which is almost as deterrent to their conversion as is the HCl). When an atrophic gastritis exists excess mucus may also interfere with carbohydrate change, although here the meal is more viscid. In absence of stomach secretion non-malignant in nature, the return smells exactly like bread.

In pyloric stenosis of marked degree, and particularly when this is due to malignant disease, the test-meal return is large in amount, dark in color (usually a coffee and milk color), and of a fetid odor. These meals on standing usually separate into three distinct layers—which have shades of the same color—and are composed as follows: the upper mucus and coarse particles of food; the middle, the largest, an opaque fluid; and the lower, the smallest, the carbohydrate substance. Such test-meals always mean marked fermentation in the stomach from pyloric stenosis and absent gastric juice secretion, and in rare cases a high grade of gastric insufficiency—motor and secretory.

A reddish tinge to test-meals is always suggestive of blood, although it may be due to certain red colored foods and drink; when observed, tests for blood should always be made. Bile gives to test-meals a yellowish or greenish color, and tests for its presence should also include those for the intestinal secretions.

Much mucus is readily observed with the naked eye. It occurs in test-meals in two forms; that from the throat and mouth which floats in thick clumps upon the top, and that from the stomach which renders the meal viscid, and can be recognized by putting a glass rod

into the fluid and withdrawing it sideways when it will be noted that the mucus adheres to the staff. Pus is not observed with the naked eye in test-meals, but may be seen when present in considerable amounts in aqueous instillations. The presence of duodenal juice is also not seen and must be examined for.

Lastly, it should be mentioned that in intestinal obstruction and where communication exists between the stomach and intestine (usually the colon), a fecal odor is observed in the meals. Very commonly in test-meals extracted from alien Russians or Italians who use garlic and onion in large amounts, the aromatic substances of these vegetables may persist in an empty stomach and give their odor to the meal—even in the apparently normal stomach. In fetid conditions about the mouth, the swallowed contaminated saliva may give a foul odor to stomach contents. Medicants, such as valerian, those containing the aromatic oils, etc., when taken at the test-meal time, or before then on the same day, may influence the odor; and thus no medicant of any sort should be permitted to be taken until after the extraction.

EXACT DETERMINATION OF THE CHYME WITHIN THE STOMACH.

Properly done, the expression method can empty a stomach in the majority of instances, and the aspiration method in all—this of course excepts particles of food that may be adherent to the mucosa particularly about the rugæ. When, however, atonic dilatation or prolapse exists, there is always a doubt that by simple expression the stomach is surely emptied of its contents. These, with the instances in which kinking of the tube is troublesome (excessive and rather constant straining), or the chyme is too viscid to raise through the tube, make it important to have some method by which the total contents can be estimated. This can be done by the method described by Mathieu and Rémond, which is the following, but which is of value only when the stomach contents are acid.

At the proper time for extraction of the Ewald meal, the tube is passed, and as much of the gastric contents as possible is secured and set aside. A funnel and extra length of tubing is now attached to the stomach-tube, and about 200 cubic centimeters of water are run at one time into the stomach. The funnel is now lowered to below the stomach level, to allow the fluid to flow back into the funnel, which later is again raised, then lowered, and so on, for a number of times until thorough admixture has taken place and after which it is secured.

The first and by far the most sensitive of all known testing reagents is dimethyl-amido-azo-benzol, either in solution (0.5 per cent.), or saturated in bibulous paper and dried. Dimethylamidoazobenzol is a yellow powder which, in alcohol, forms a yellowish-pink solution, or when used in the form of the popularly called "dimethyl paper" a yellow color. These when brought in contact with free hydrochloric acid strikes a reddish-pink depending in depth of color more upon the amount of free acid present than upon the amount of reagent solution added. (Plate 2, Fig. 1.) Krukenberg[3] has found that this reagent will detect as small an amount as 0.002 mille of hydrochloric acid.

Another excellent reagent is tropeolin 00. This salt when dissolved in alcohol forms a yellowish-brown solution which an acid turns to a red. The organic acids also strike a similar color but the distinction between these and hydrochloric can be performed in the following manner. Three or four drops of a saturated solution of tropeolin are placed in a porcelain dish, and the solution is spread over its interior. Into this an equal amount of gastric juice is added, and the dish is again moved so as to thoroughly mix the two. If the dish is now gently heated over a small flame, lilac or blue stripes form at the edges which are positively due to hydrochloric acid, since no organic acids in any concentration can form them (Boas).

Another test which in my hands is most valuable is by means of the Günzburg reagent which is composed of

℞	Phloroglucini	2.0
	Vanillini	1.0
	Alcoholis absoluti	30.0

This is a sensitive and most reliable test for free hydrochloric acid; organic acids, albumins, peptones or acid salts not interfering with it. When first made the solution is yellow in color which turns to a brown when exposed to light; therefore, it should be kept in a dark colored bottle, and preferably freshly made. For this reason the method which Lenhartz has suggested is serviceable; namely, to have on hand separate solutions of phloroglucin and vanillin, 1 or 2 drops of each being employed in the test. This is simply accomplished by having a two to thirty phloroglucin alcoholic, and a one to thirty vanillin alcoholic solution, employing two drops of the first and one of the second. To this in a porcelain dish a few drops of the gastric filtrate or the unfiltered contents is added and slowly evaporated, at which if 0.05 per mille or more of free hydrochloric acid is present a general rose tint or rose colored lines develop. (Plate 1, Fig. 1.)

PLATE XX.

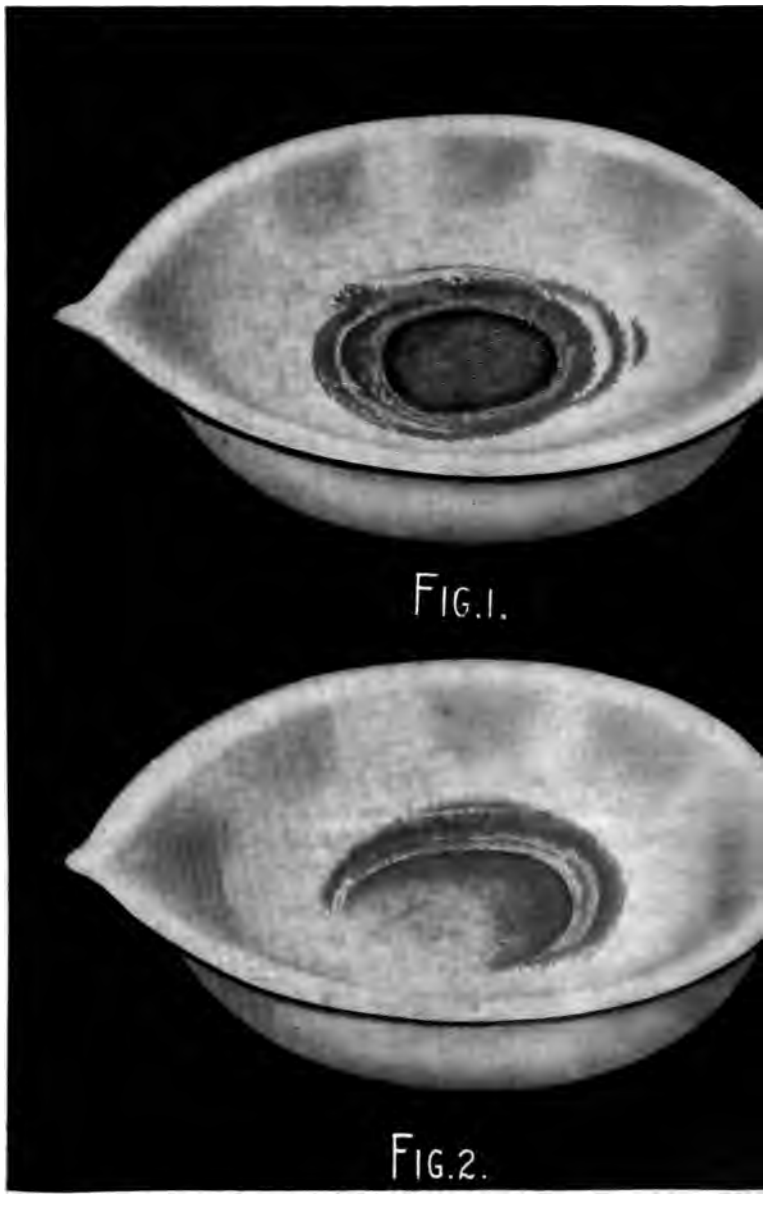


Fig. 1.—Phloroglucin-vanillin test. (Günzburg's reagent.)

Fig. 2.—Resorcin test. (Boas' reagent.)

This color remains when the dish is cool. One must be careful not to heat the dish too rapidly or burn its contents since a confusing brownish-red color will be obtained. For this reason it is best when heating to hold the dish some distance above the flame, and blowing into its contents occasionally to drive off the excess heat and hasten evaporation; or to protect the containing dish by a second one under it, and applying the heat to the latter. Phloroglucin-vanillin test paper can be purchased or made, but is not so reliable or sensitive as the reagent itself.

The Boas reagent, the so-called resorcin-test, is also to be recommended. It possesses the advantage over the above of greater stability and is equally as delicate and reliable. This reagent is composed of

℞	Resorcini resublimati	5.0
	Sacchari albi	3.0
	Alcoholis (94 per cent.) diluti	ad 100.0

The test is performed by treating five or six drops of gastric filtrate with three to five drops of the reagent and slowly evaporating to dryness over a small flame, when a rose or vermilion-red will be seen when free hydrochloric acid is present but not with the organic acids, acid salts, etc. The color disappears on cooling. (Plate I, Fig. 2.)

Comparing the above tests it may be said that the dimethyamidoazobenzol (Töpfer's) is the most sensitive, fades out in time, and may give a red color with the organic acids when these are present in large amounts—such as 0.5 per cent. of lactic (such large amounts of organic acids are rarely encountered in gastric filtrates). That the phloroglucin-vanillin (Günzburg's) and resorcin (Boas') are the most reliable tests for free HCl when this is present in amounts over 0.05 per mille—since they are not affected by any of the other constituents of gastric filtrates. That tropeolin 00 is the least sensitive, requiring 0.3 or more per mille of HCl to produce the reaction, and that the color obtained must be differentiated from that of the other acids. And lastly, that Congo red and red litmus merely denote that the filtrate is acid in reaction without specifying whether this acid is mineral or organic in nature.

QUANTITATIVE ESTIMATION OF HYDROCHLORIC ACID, AND TOTAL ACIDITY.

The free hydrochloric acid appears in the gastric contents after all basic affinities have been saturated. During the early process of gastric digestion such HCl as had been secreted unites with the albuminoid and basic substances of gastric contents and is present in a combined state with them, and tests for the free acid are usually negative or the estimations very low. Therefore it is that its mere presence in small amounts or the absence of free HCl does not permit us to infer that errors of this secretion exist, unless such estimations are made from contents removed at the height of gastric digestion.

In stomach contents removed at this time so much basic affinity may exist for saturation that a low free HCl may be noted; still, when the total HCl—free and combined—are estimated, a normal HCl secretion is manifest, and, on the other hand, these basic affinities may be so low in amounts that free HCl is present in a large amount at an early period.

In the normal human stomach the hydrochloric-enzymotic secretion of gastric juice in amount is usually beyond the saturating requirement of the proteid contents. That is to say, that represented in the HCl the normal stomach secretes this acid in excess of the amount necessary to saturate even a mixed meal. This provision of nature insures enough gastric secretion for meeting the demands that the stomach contents may require to the very end of gastric digestion, supplies enough free HCl for stimulation of the duodenal secretions for intestinal digestion, and probably also to maintain the normal pyloric reflex which presides over the opening and closing of the exit for foods. A mixed meal extracted in two or three hour intervals may show a low free hydrochloric acid, but a very high amount of acid combined with the large amount of proteid, while the same stomach with a simple meal may manifest in a one-hour interval about as much free as combined acid—because of the relatively lower proteid content of the Ewald breakfast. It is upon the acid secretion running too high in amounts (usually represented in the free acid) that diagnoses of increased secretion are made and for this reason the quantitative estimations of the total hydrochloric acid contained (free and combined) are important.

All authorities have agreed that the amount of hydrochloric acid varies between 0.1 and 0.22 per cent. Added to this in all meals is an organic acid content which is also represented in both free and combined states, and a phosphoric acid content which is represented

in acid phosphates. The following schema of the acid of an Ewald meal is offered :—

Hydrochloric acid { Free. / Combined (with albuminoids, basic substances).

Organic acid { Lactic, Butyric, Acetic } Free. / Combined (with albuminoids, basic substances).

Phosphoric acid—combined (with albuminoids, basic substances).

Töpfer's Method.—The free and combined hydrochloric acid and the total acidity are most conveniently estimated by this method, which is both simple and accurate enough for ordinary clinical purposes. The method determines the acid factors separately by the use of three different indicators; the free hydrochloric acid and the total acidity are estimated directly, and the combined hydrochloric acid indirectly. The solutions employed are:—

1. A 0.5 per cent. alcoholic solution of dimethylamidoazobenzol.
2. A 1 per cent. alcoholic solution of phenolphthalein.
3. A saturated aqueous solution of alizarin.
4. A decinormal solution of sodium hydrate.

No. 1 is used to estimate the amount of free HCl; No. 2 the total acidity (free and combined mineral and organic acids); No. 3 the amount of free HCl, free and combined organic acids and phosphates —all acidities excepting the combined HCl which is figured in amounts from the result noted by that obtained with No. 2; and No. 4 is a standard alkaline solution used to neutralize the gastric filtrate.

The author's technique of procedure is as follows: 5 or 10 cubic centimeters (preferably 10) of gastric filtrate are placed in a porcelain dish 9 centimeters in diameter. Into this are put two drops of the dimethyamidoazobenzol solution at which the filtrate turns a red color in the presence of the free HCl. Titration with the decinormal lye solution is now carried on until the reddish tone disappears and gives place to a canary-yellow (Plate 2, Fig. 1). The end reaction is a yellow tinged with green and not a yellow wherein some of the lurking red tone is evident. The quantity of alkaline solution used is now noted and, with the subsequent analyses, figured as below. The next step is to estimate the total acidity. For this, the same filtrate can be used, or a new portion employed. One or two drops of phenolphthalein solution is now added (which does not change the color), and titration is continued until a permanent pink is obtained (Plate 2, Fig. 2). Care must be taken that the end reaction of this is carefully performed. The term "permanent pink" means the point at which the addition of an extra drop of lye solution does not deepen the red color,

and not the first permanent pink tint that the entire filtrate assumes before the end reaction is reached. To properly gauge this it is wise to let the last drops of the burette solution fall upon the side of the dish or added to the filtrate by means of a glass rod. As long as a drop of the neutralizing solution added to the filtrate shows a ring which is decidedly deeper in red color than the rest of the filtrate, the end reaction has not been reached. The quantity of lye solution employed is now noted and added to the amount employed to neutralize the free HCl—to gain the total acidity—or, if a second quantity of filtrate has been used, the total amount that was used.

The next step is to estimate the quantity of combined hydrochloric acid. For this a new portion of filtrate is necessary, into which three or four drops of the alizarin solution are added—the reagent being a dark-brown solution usually changes the color of the filtrate slightly in that direction. Titration is now carried on through the free HCl, the free and combined organic acids, and the acid phosphate. As this proceeds, different filtrates from normal stomachs differ in the play of color observed. Some will pass through a reddish stage, some through a burnt carmine, and others again through a purple lake. The end reaction is always the first appearance of a pure violet color (Plate 2, Fig. 3). The amount of alkaline solution employed to obtain the purple, subtracted from the amount employed to neutralize the total acidity in the second instance, will represent the figure corresponding to the amount of combined hydrochloric acid the filtrate contains, and this estimation added to that of the free HCl gives the total hydrochloric acid content. These estimations can be made in the other manner—that is, first the total acidity, then the free HCl, and lastly the combined HCl. The first routine I have outlined is the better, however, since in the latter way three separate portions of filtrate are necessary, and the test-meal return when filtered may be too small in amount to permit of complete analyses.

A liter of normal solution of hydrochloric acid contains 36.5 grammes of hydrochloric acid, and thus each cubic centimeter of decinormal solution of sodium hydrate would correspond to 0.00365 of hydrochloric acid (remembered by 365 being the number of days in a year). It is required to figure from the number of cubic centimeters of lye solution used to neutralize the 5 or 10 cubic centimeters of the filtrate the corresponding amount that is represented in 100 cubic centimeters of each—that is, 20 or 10 times the amount of filtrate and alkaline solution, and thus the quantity of lye solution used must be multiplied by these latter figures. For instance, assuming that 10 cubic centimeters of filtrate are employed, in which 3 cubic centimeters

ıtion represents the free HCl, 7 cubic centimeters the total ıd 4 cubic centimeters the alizarin reaction, the result then ls would be the following:—

Free hydrochloric acid	30 degrees
Combined hydrochloric acid	30 degrees
Total HCl	60 degrees
Total acidity	70 degrees

:ead of degrees we wish to represent the quantities in per- ıe figures thus obtained are multiplied by 0.00365. Taking for example, the total HCl of 60 by 0.00365 = 0.219 per cent. of cally active hydrochloric acid. hese examinations a graduate of , preferably the cylinder form of :entimeter capacity, or a volume- : graduated in like amounts, is re- measure the filtrate, and some burette to measure the quantity ution delivered into it. Among named apparatus employed, the tand burette of 10 cubic centim- ity answers well. Care must be with the hand burette that the ling the contents in the tube is lye solution cannot be delivered The objection to the small-sized ette is that a funnel is required nd as it is desirable not to permit contact of air with the caustic ion (soda carbonate formed) the latter form is an advantage when mations are being made.

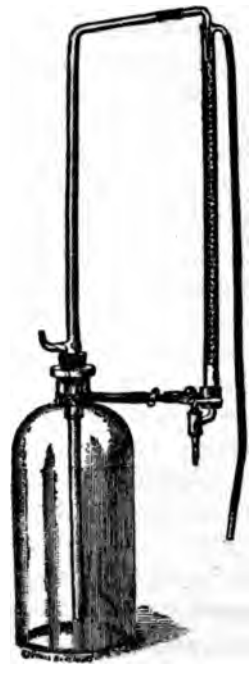


Fig. 33.—Automatic burette. Squibb's latest form.

: past years a number of other 'or estimating hydrochloric acid in test-meals have been Among these may be mentioned the method of Martius ke[4], Leo[5], Hayem-Winter[6], and others. All of these ;reater expenditure of time, a more complete laboratory out- : rarely necessary. Still, when hydrochloric acid is present nall amounts or absent by the usual tests, the method of nd Lüttke or Hayem-Winter would be of value since at s doubt may exist in the obtaining of the biuret-test for the

peptones. Of the two, I prefer the Hayem-Winter method, which in my hands has been successful in detecting the presence of secreted chlorine in considerable amounts in cases which have been previously diagnosed as "achylia gastrica." This is particularly interesting when one considers that such a complicated procedure is apt not to be exact, and even that the addition of heat is liable to decompose the ammonium chloride present in gastric contents and form free hydrochloric acid. I believe that there are instances of a low hydrochloric acid secretion wherein its very small amounts under certain conditions (of gastric fermentation possibly) cause an intimate union with the organic substances, and that these are not manifested by the Töpfer reagents and too indistinctly so for practical deduction by the biuret reagent.

Hayem-Winter Method.—By the method of Hayem and Winter, the chlorine, which in gastric contents is partly fixed by combination with bases as salts and partly present as hydrochloric acid, is determined in two separate estimations. In the first, all the chlorine is fixed by the addition of sodium bicarbonate and is then determined; in the second, the addition of sodium bicarbonate is omitted so that in the process the chlorine of hydrochloric acid escapes and only the originally fixed chlorine is determined. The difference between these two results gives the quantity of chlorine present as hydrochloric acid, including both the free and the organically combined. It will be noticed that the author mentions but two steps in the procedure, while that of the complete method as advanced by Hayem and Winter has three. My reason for these are, that I have found that the method for estimating the amount of free HCl is not to be relied upon, and for qualitative analysis the Günzburg test is more satisfactory. What concerns us particularly is, has hydrochloric acid been secreted, and if so, in what amounts? Therefore, only the first and last steps are of importance. This method is conducted as follows:—

1. *Total Chlorine (fixed and hydrochloric acid).*—Accurately measure 5 cubic centimeters of the gastric filtrate into a small porcelain dish and add about 2 cubic centimeters of a solution of sodium bicarbonate (enough to more than neutralize any acidity). Evaporate to dryness, preferably on a water bath, and thoroughly ignite over a free flame avoiding heat that will produce more than a very dull redness. When cool, extract with boiling hot water, slightly acidifying with nitric acid, and filter, repeating the process till the filtrate is free from chlorine (no turbidity when a drop of silver nitrate solution and nitric acid are added to a half inch of the filtrate in a test-tube). To the filtrate washings, which should be clear and colorless, add an excess of calcium carbonate and heat the mixture to drive off free carbon

dioxide. About 2 cubic centimeters of a 3-per-cent. potassium chromate solution are added and the mixture titrated with decinormal silver nitrate until a faint but permanent red coloration is produced. The number of cubic centimeters of silver nitrate solution used multiplied by 20 gives the degrees of the total chlorine present (expressed in terms of acidity).

2. *Fixed Chlorine.*—Proceed as in (1) omitting the addition of sodium bicarbonate. The number of cubic centimeters of silver nitrate employed in the titration multiplied by 20 gives the degrees of the fixed chlorine present (expressed in terms of acidity).

3. *Chlorine Present as Hydrochloric Acid.*—Subtract the result in (2) from (1). The difference is the hydrochloric acid expressed in degrees of acidity. This is the total quantity of hydrochloric acid as such in the gastric contents, and accordingly represents what has been secreted by the stomach.

Considering now, as Kossler[7] has suggested, that by this method less chlorine is to be found in the residue than was originally present in the gastric contents, then the instances in which I have obtained differences in results between A and B—and particularly when the gastric proenzymes are also present—must mean gastric juice secretion, even if the simpler method gave negative results in the hydrochloric acid estimations.

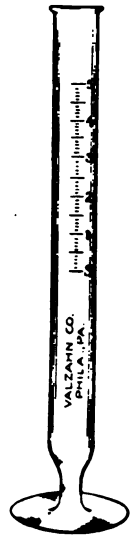


Fig. 34.—Acidometer of Dr. Raue.

For quick clinical work, such as may be desirable in dispensary practice in the average case, the so-called "acidometer" may be used for estimating the amounts of free hydrochloric acid and total acidity—but not the combined or the total HCl. The use of this graduated cylinder is also of value when only small amounts of filtrate are obtained so that dilution of it with distilled water may be called for to make bulk enough of fluid for estimation. Patterned after the Citron instrument, Raue[8] has devised an instrument which possesses the advantage of having a stand and fewer graduations. The method of procedure is as follows:—

The acidometer is filled with gastric filtrate to S, a drop of dimethylamidoazobenzol solution is added until the end reaction of the free acid is obtained (yellow). Now read off the amount of alkaline solution used by consulting the graduations and the amount multi-

filtrate extract described above or the unevaporated ether described below is added, and in the presence of 1 or more per cent. of lactic acid, a canary-yellow color is obtained (Plate 3, Fig. 1).

Instead of evaporating the ether as above described, the ethereal extract may be added directly. For this purpose the employment of the Strauss separating bottle is handy and permits of roughly determining the amount of lactic acid present. Into the instrument shown here, 5 cubic centimeters of the filtrate are placed and ether added to the 25 cubic centimeter mark, and, after shaking thoroughly the apparatus, it is held upright until the ether separates, the cock is then opened and the gastric filtrate permitted to run out until the lower ether line reaches the 5 cubic centimeter mark. The 20 cubic centimeters of ethereal extract remaining in the separating bottle can be used for the Uffelmann test, either by first evaporating to 5 cubic centimeters, or in its entire quantity. Evaporation is easily accomplished by running the contents of the bottle into a test tube which is placed in a glass of hot water. Partial evaporation is always preferable to employing the entire amount.

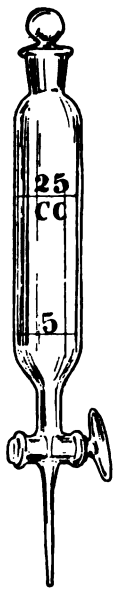


Fig. 35.—Strauss separating bottle used in making quantitative estimations of lactic acid.

Strauss' Method.—Instead of employing the ethereal extract in the performance of the Uffelmann test, Strauss[9] has advanced a modification which is much superior. The plan of separation is carried on as outlined above, but to the 20 cubic centimeters of ethereal extract distilled water is added to the 25 cubic centimeter mark. Two drops of the officinal tincture of ferric chloride in 18 drops of distilled water are now added to the contents of the bottle and vigorously shaken. Upon shaking, the water will assume an intensely green color if more than 1 pro mille of lactic acid is present, and a lighter green with less. In my experience with this method I have never observed a filtrate of the Boas meal give a green color (even light) which was not from a pathological stomach.

Kelling's Test.—To Kelling[10] belongs the credit of advancing the most delicate and also the simplest test for lactic acid in gastric filtrates. As advanced by this observer, the gastric filtrate is diluted (in a test tube) ten or twenty times its volume with water, and this is treated with one or two drops of a 5-per-cent. ferric chloride solu-

PLATE XXII.

Fig. 1.—Uffelman's test for lactic acid.

Fig. 2.—Kelling's test for lactic acid. (Simon's modification.)

tion. As in the Strauss method (which was advanced after Kelling, but which employs an ethereal extract) a greenish color with transmitted light shows the presence of lactic acid. This test will react to lactic acid in dilutions of 1 : 10,000 to 1 : 15,000. Simon[11] has modified this test in the manner of adding the gastric contents to the dilute iron solution, and employing a control to observe the color change. The test is carried on as follows. In a test tube of distilled water one or two drops of ferric chloride solution is added, so as to barely color the water. One-half of this is poured into another test tube of the same caliber and serves as a control. A small amount of gastric filtrate is added to one of the test tubes, when in the presence of lactic acid a distinct yellow color develops at once, which appears more marked when compared to the control (Plate 3, Fig. 2). This change of color can usually be observed by transmitted light, but when in doubt is best done by taking the tubes into a strong light and looking down through the solution, when a definite reaction will be noted as a darker brown than the control. In experimenting with this method with filtrates containing different percentages of lactic acid, I have observed that with 3 cubic centimeter quantities of filtrates containing respectively ¼, 1, and 4 per cent. of lactic acid the same depth of yellow is always produced in 15 cubic centimeters of water and one drop of iron solution, therefore in these percentages the depth of color observed cannot be employed to note the percentage of lactic acid present. On the other hand, to show the delicacy of the test a definite reaction can be produced with 3 cubic centimeters of filtrate containing only .0015 per cent. of lactic acid. From the latter it will be observed that in a positive reaction with 3 cubic centimeters of filtrate in 15 cubic centimeters of water (making up the reagent), at least .0015 per cent. of free lactic acid is present, and as less gastric filtrate is employed in successive tests a fair idea of percentage is obtained. As an instance, a definite reaction is just about procured in the above mentioned amount of reagent, by 3 drops of a 1-per-cent., 2 drops of a 2-per-cent., or 1 drop of a 3-per-cent. solution of lactic acid. Gastric filtrate containing more than 3 per cent. of lactic acid can be diluted with water and the result figured accordingly. It must finally be mentioned that in this rough method of estimating percentages, not the definite yellow color produced in the perfect reaction is considered, but only a yellow which is distinct enough from the control that when the tube is shaken it is plainly noticeable.

Boas' Rapid Method for Quantitative Estimation of Lactic Acid.—This method possesses an advantage over the more complex one advanced by the same author[12], in that it takes less time, does not

require the various reagents necessary in the longer method, and is sufficiently accurate for clinical purposes. Ten cubic centimeters of gastric filtrate in a test tube is treated with a few drops of dilute sulphuric acid and heated and filtered to remove the albumin. The filtrate is evaporated to a syrup on a water bath, water added to the original amount, and this is again evaporated to a small volume to remove the fatty acids. The lactic acid remaining is now extracted with 200 cubic centimeters of ether, the ether is evaporated, the residue taken up with water, and titrated with a $\frac{1}{10}$ normal solution of sodium hydrate, using phenolphthalein as an indicator. As 40 parts by weight of sodium hydrate combine with 90 parts by weight of lactic acid, and as 1 cubic centimeter of $\frac{1}{10}$ normal solution of sodium hydrate contains 0.004 gramme of sodium hydrate, the corresponding amount of lactic acid is found from the equation:—

$$40.90 : 0.004 : x : 40;\ x = 0.360;\ x\ 0.009.$$

or 1 cubic centimeter of one tenth normal solution of sodium hydrate corresponds to 0.009 of lactic acid.

By multiplying the amount of cubic centimeters of lye solution used by this figure, the amount of lactic acid present in 10 cubic centimeters of gastric filtrate is ascertained and the result multiplied by 10 indicates the percentage. In this method, a part of the lactic acid escapes with the heating and evaporation and thus the figure obtained is usually slightly short of the actual amount the gastric contents originally contained.

VOLATILE FATTY ACIDS.

When much milk, butter, or carbohydrates are ingested, fatty acids may be formed in small amounts in the normal stomach, and it is not uncommon in patients convalescing from febrile disease who are partaking heavily of these foods in fluid form to present small amounts of fatty acids in stomach contents, which acids disappear when the recovery is more advanced and a mixed diet has been resumed. In amounts difficult to ascertain, the fatty acids (the same as lactic acid) may be present in contents from normal stomachs, but when plainly evident, some pathological condition of the stomach is usually present. Among the conditions in which this is so, are states of excess gastric juice secretion, atony, chronic gastritis, and in benign stenoses of the pylorus where HCl secretion is present. In cancer, fatty acids may exist with lactic acid, the latter, as Flügge has shown, probably derived to an extent from butyric acid as well as a direct product of the fermentation. In early cancer, the fatty acids may be

esent to a greater extent than lactic acid. Acetic acid fermentation common in alcohol drinkers, but may be formed by the action of ast upon sugar. Excepting in alcoholics, butyric acid fermentation more common than acetic. The presence of the volatile fatty acids increased amounts can easily be tested for by gently heating about cubic centimeters of gastric filtrate in a test tube over the top of hich is placed a strip of blue litmus paper which turns red while on e tube, and in a short time returns to a blue color again when the ltrate is cold or if the paper had been taken away. A quantitative stimation of the amount of fatty acids can easily be determined by btaining the acidity of 10 cubic centimeters of gastric filtrate. Another 10 cubic centimeters are evaporated to a syrup (during which he fatty acids volatilize), water is then added to a 10-cubic-centimeter otal, and similarly titrated. The difference in acidity between the vo represents the amount of fatty acids present.

Butyric Acid Tests.—Butyric acid, in even slight amounts, can sually be recognized by its odor alone, which is that of rancid butter. 'hen acetic acid is mixed with it, this odor is somewhat masked and e following tests may be utilized.

Ten cubic centimeters of gastric filtrate are extracted with 50 bic centimeters of ether. This is evaporated and the residue treated ith about 2 cubic centimeters of water. If a few crystals of calcium loride are added, a separating of butyric acid takes place in the form small fat globules, which have the characteristic odor of the acid; the dry residue of the ethereal extract may be treated with a little lphuric acid and alcohol at which ethyl butyrate is formed and ich can easily be recognized by its distinct pineapple odor.

Acetic Acid Tests.—Acetic acid is recognized by its pungent odor, hich is that of vinegar. Ten cubic centimeters of gastric filtrate are tracted with ether, the residue dissolved in a little water, and utralized with a solution of sodium carbonate (sodium acetate being rmed). To this is now added a drop or two of very dilute ferric loride solution, at which a deep red color results. Furthermore, ver nitrate produces a precipitate which is soluble in hot water. other test is to add to the evaporated ethereal extract dissolved in a tle water and neutralized with a solution of sodium carbonate, a few ps of sulphuric acid and alcohol, after which the characteristic odor be observed on heating.

BLOOD IN GASTRIC CONTENTS.

The presence of blood in gastric contents is usually recognized without difficulty by its bright-red color when fresh, and its dark-brown or blackish color when altered by the gastric juice. There are filtrates in which the blood is too small in amount to be recognized by the eye, or changed to such an extent that on macroscopic examination doubt exists as to its presence, and lastly the important form in which blood may be present and no color is imparted—namely, the so called "occult blood." In these latter instances, chemical tests for the presence of blood are important, because of the doubts (above mentioned) in the macroscopic examination, the fact that it is unsatisfactory to microscopically search for blood corpuscles in the amylum of test-meals, and the fact that the red corpuscles may have been dissolved and thus not be recognizable.

Blood in the stomach contents is found particularly in gastric cancer and ulcer. It may occasionally be present in benign stenoses of the pylorus, and less often in chronic gastritis (from the "catarrhal ulcers"). It may be present in small amounts in acute gastritis (particularly the toxic types, and rarely in phlegmonous gastritis. It is not uncommonly found in gastric sarcoma of a primary nature, but not in multiple sarcomata in which the stomach walls are secondarily involved. I have observed it in small amounts in a few cases of primary gastric atony, and once in injury to the epigastrium. Among the other conditions in which it may be present in the stomach, is the traumatic variety from the expression method of extraction, and that swallowed from the nose, lungs, or esophagus; from rupture of an aneurism into the gullet or stomach; in the passive congestions due to heart or lung disease, or obstructive states of the portal circulation; in the severe anemias, hemophilia, scurvy, purpura hemorrhagica, and vicarious menstruation; in Hodgkin's disease, and in the infectious diseases—such as typhus, yellow, malarial or relapsing fevers, malignant small-pox, hemorrhagic scarlet fever, etc.

General Extraction of the Hemoglobin Present.—Before beginning a consideration of the various chemical tests for blood in gastric filtrates (as well as in feces), it is important that the blood constituent be extracted. For this purpose a method of extraction which will serve for all of the various chemical tests is desirable instead of the various different methods given in the routine of the different tests as they were originally advanced. A method I have found satisfactory for gastric filtrate and feces is the following. As much of the gastric filtrate as is on hand, or about one-half a test tube of a watery

solution of feces, is treated with one-third its volume of glacial acetic acid, and one-half its volume with ether. The mixture is thoroughly shaken and allowed to stand for fifteen minutes, or until separation is complete. Should this be tardy the addition of a few drops of ethyl alcohol will hasten it and centrifuging also helps materially in the separation. When the ether has separated, dissolved in it will be the hemoglobin from the blood present, and this is tested for in the following ways. (In my opinion, it is advisable not to depend upon any one chemical test for blood, but to perform two or three of them with each obtained acetic ethereal extract).

Guaiac Test.—This test is delicate enough for practical purposes but not as satisfactory in the routine way as the benzidine or the aloin. The test is accomplished by the oxidation of guaiaconic acid in the presence of blood into a guaiac blue the color of which is easily recognized. The testing solution of guaiac is made in several ways but the one included is advised. A fresh alcoholic solution of guaiac is made by scraping (with a knife) a few grains of old gum guaiac into about 5 cubic centimeters of alcohol. (The area of the guaiac which has yellow particles in it is the most sensitive solution for the reagent.) To the alcoholic-guaiac solution is added about 2 cubic centimeters of hydrogen peroxide and the contents are shaken. To this mixture is added about 1 cubic centimeter of the acetic-ethereal extract and in the presence of the blood a blue-violet color will appear in the upper part of the mixture (Plate 4, Fig. 1). In the examination of feces containing blood, a purplish-brown color may be noted due to the blood and the urobilin contained in the extract. If no blood be present no color at all or only a faint brown would occur from the urobilin.

Aloin Test.—This test is a very valuable one for blood and, with the following, has my preference over the above. The reagent is prepared as follows. In a test tube about one-third filled with a 70-percent. alcohol, a small amount of powdered aloin is added (about as much as will hold on the tip of a spatula) and a few minutes are allowed for it to dissolve. About 3 cubic centimeters of the acetic-ethereal extract is placed into a tube, to which an equal amount of the aloin solution is added. The mixture is treated with 1 or 2 cubic centimeters of thoroughly ozonized turpentine (prepared by allowing chemically pure turpentine to stand exposed to the air for about a month), or an equal amount of hydrogen peroxide (the turpentine is best). The mixture is thoroughly shaken and if blood is present the reaction appears in the lower part or all of the solution turning a cherry red in a short time. If the ozonized turpentine is added drop by drop only the lower part shows the depth of color (Plate 4, Fig. 2).

The reaction is not as quick as that of the guaiac or benzidine tests, and some minutes may be necessary for it to be pronounced. But in this connection it must be remembered that not more than 15 minutes should be allowed for this to manifest itself, because beyond this time the mixture will develop a red color even if no blood be present.

Benzidine Test.—This test has recently been advanced by O. and R. Adler[13], and is strikingly sensitive to blood. Unfortunately such substances as potato, milk, and farina may strike the reaction and therefore it is not so applicable for feces examinations, but in test-meal work it is sufficient to remember that nothing in the white bread and water of the Ewald meal can produce it, and thus when the filtrate of a simple meal from a non-stagnant stomach gives the reaction blood is invariably present. The reagent is prepared by dissolving about as much benzidine crystals (Merck) as will hold on the end of a spatula in one-third of a test tube of 70 per cent. alcohol. When the crystals are dissolved, an excess of hydrogen peroxide is added (about one-fourth of the amount), and to the top of this the acetic-ethereal extract is added. When blood is present an intense green color ensues (Plate 4, Fig. 3), and when absent, only a milky white. A paper soaked with benzidine solution and dried has recently been advanced by Einhorn[14], which, in my hands, is not as sensitive as the above method, and rather difficult to handle properly.

Hemin Crystals.—Hematin readily combines with one molecule of hydrochloric acid to form hemin. This substance crystallizes in brown plates or columns and when produced by means of glacial acetic acid are large in size with small star or rosette crystals in addition. The formation of hemin may be obtained from mere traces of blood, and when produced from gastric filtrates are conclusive evidence of the presence of blood. Negative results from the test should not be considered as conclusive of the absence of blood because substances in the filtrate may interfere with the formation of these crystals even when blood is quite plainly present to the naked eye. To observe the crystals, a small sample of gastric filtrate is carefully evaporated on a watch crystal over a small flame, and the residue is scratched free and mixed with a grain or two of finely powdered salt (sodium chloride). This is transferred to a microscope slide, heaped in a small area, and a drop or two of glacial acetic acid added. The slide is now gently heated for a minute, or until bubbles begin to form, allowed to cool, and examined under the microscope with a one-sixth or a one-seventh objective. The hemin crystals (hydrochlorate of hematin) are readily observed by directing attention to the little brown clumps (Plate 4, Fig. 4).

Iron Test.—Providing the patient is not taking an iron preparation this test is of value. It is simply performed and very sensitive to even the most trivial amounts of blood. It is carried out by placing a small amount of the unfiltered gastric contents in a porcelain dish, mixing it with a pinch or two of potassium chloride and a few drops of concentrated hydrochloric acid, mixing these thoroughly and heating the contents over a small flame to drive off the water and chlorine and obtain a perfectly dry residue. A few drops of a diluted solution of potassium ferrocyanide are added at which, when blood is present, the color of Prussian blue ensues (Plate 4, Fig. 5).

Spectroscope.—When blood is present in the fresh state the gastric filtrate may be examined directly and the two strips of oxyhemoglobin observed. These are seen by the two bands of absorption between D and E. The one to the left is narrower, darker, and more sharply defined than the second (Plate 4, Fig. 6, A). Because blood in gastric contents is commonly more or less reduced by the hydrochloric or the organic acids in the stomach, and hydrochlorate of hematin is produced; this, being insoluble in water, may not give absorption bands, and because chlorophyll (the green coloring matter in vegetables) gives absorption lines similar to a solution of hematin, Weber has advised a treatment of the gastric filtrate or aqueous feces mixture with alcoholic potassium lye and the extraction of the blood pigment from an ethereal extract in a watery alkaline solution which is treated with ammonium sulphate. The resulting liquid, red in color, would then give the absorption bands of reduced hemoglobin which have two lines in the green. Reduction of the oxyhemoglobin can be obtained by directly reducing the oxyhemoglobin by means of "Stokes fluid," or ammonium sulphide (Plate 4, Fig. 6, B). Spectroscopic observations are not preferable for gastric filtrate or feces examinations to the simpler chemical tests.

BILE AND ENTERIC SECRETIONS IN GASTRIC CONTENTS.

Bile in the stomach is present in stenosis of the intestines, late in excessive vomiting in migraine, in vomiting from dietetic error, or in the morning pathological and even the healthy stomach. With the exception of the morning stomach, it is usually present with the enteric secretions and tests for these will here be included.

Tests for Enteric Secretions.—The presence of bile can readily be recognized by the yellow color it imparts to the gastric contents or lavage water, and as the most trivial amounts are discernible to the naked eye further tests for it are not necessary.

The presence of succus entericus can only be assumed when bile and the pancreatic juice are both present. Tests for this particular secretion have not been advanced as yet and it seems to me would not serve of much practical importance if they had been.

The demonstration of pancreatic juice is possible only if the reaction is alkaline, as the pancreatic trypsin is destroyed or inhibited by the pepsin-hydrochloric contents of the stomach. Tests for the presence of the pancreatic enzymes are performed by first rendering the gastric filtrate alkaline by the addition of a 1-per-cent. solution of sodium carbonate, and the separate ones are tested for in the following manner.

Trypsin.—The addition of the alkaline solution inhibits the action of the pepsin and makes possible that of the trypsin. A small amount of the gastric filtrate is placed in a test tube to which is added a flake of fibrin, or a few flakes of fibrin previously colored by immersion in a little Megdala-red solution, after which they are washed and dried. The test tube is placed in a thermostated oven, in which, after a time, the fibrin dissolves, and produces tyrosin and leucin. With the employment of the red fibrin flakes, as digestion takes place the red is liberated coloring the filtrate.

Amylopsin.—This diastatic ferment acts quite the same as the ptyalin of the saliva (which is also an alkaline secretion), and because more or less saliva is generally present in all stomachs, tests for this ferment are not of so much practical value as those for trypsin and the fat splitting ferment (lipase). The test for the diastatic ferment consists of mixing 1 or 2 cubic centimeters of the alkaline gastric filtrate with about four times the amount of dilute starch paste, placing this in the water-oven for a short time or in a glass of warm water, and then testing for maltose by means of the Fehling test.

Steapsin.—The test for this is simply accomplished by placing a few drops of the alkaline gastric filtrate on a watch crystal, to which a like amount of neutral olive oil is added with one or two drops of alcoholic rosolic acid, at which the mixture takes on a pink color. The mixture is now covered hermetically with a second watch crystal, placed in a water-oven for about an hour and, when lipase is present, the pink color gradually disappears.

To measure the lipase, Hanriot and Camus have suggested a method wherein a solution of monobutyrin is employed. They take one cubic centimeter of the liquid to be tested and measured and add to it 10 cubic centimeters of a 1-per-cent. solution of monobutyrin. The solution is carefully neutralized with sodium carbonate and then heated to 25° for twenty minutes. Under the influence of lipase, the liquid

becomes acid, and this acidity is estimated by again neutralizing the solution with sodium carbonate; the number of drops serves to measure the fat-splitting activity. The solution of sodium carbonate used for the saturation is prepared in such a way that each drop of the alkaline liquid neutralizes 0.000001 of a gramme-molecule of acid. The ferment power is expressed by the number of millionths of a gramme-molecule of acid freed during twenty minutes at 25°. The molecular weight of butyric acid being 88 the computation is easily made.

GASES IN THE STOMACH.

A more or less quantity of mixed gases, which have been swallowed, passed into the organ from the duodenum, or generated in the fermentation process when carbohydrates or fats have been ingested, is found in normal stomachs. The gases commonly found are nitrogen, carbon dioxide, and oxygen, and, according to Planer, with a strict vegetable diet, hydrogen in addition. It therefore follows that a certain quantity of these gases must be considered as a normal gastric content, and it is only when their volume per cent. is too high, or when other gases, as marsh gas, hydrogen sulphide, and ammonia, have been added that they are of pathological significance.

In high degrees of gastric stagnation, when carbohydrate fermentation and proteid decomposition are marked, the general gaseous content may be high. Strangely enough in gastric ulcer, when gastric juice secretion, hypermotility, and a patent pylorus are present, increased fermentation of gastric contents are not uncommonly seen, and this, in my opinion, is due to the increased amounts of bacteria found in the stomach during ulceration and constitutes a valuable diagnostic sign when other findings are not significant. It has been reported, that in gastric neuroses slightly increased degrees of fermentation of gastric contents may be noted particularly in these types in which the hydrochloric acid content runs high. To this teaching I wish to take a stern exception, because figuring gas results from the fermentation of neutralized test-meals in those cases such is not so and only the merest bubble is ever seen in any of them. While such cases may have been diagnosed as neurotic conditions in the past, the majority, if not all, are states of gastritis with increased amounts of volatile organic acids or states of ulceration with increased bacteria in the stomach. In ulcer the gases commonly observed are those normally present, and not the putrefactive forms from albuminoid decomposition, such as ammonia and hydrogen sulphide. In nervous eructation, where the belching of gas is usually the swallowed gases

from the esophagus, increased fermentation of gastric contents is not seen, and thus a low gas result would serve to differentiate whether the symptom of post-meal eructation was due to the foods themselves, or just a neurotic disturbance of the stomach.

Clinically, in stagnant conditions of the stomach not so much diagnostic value can be placed upon the gaseous products of albuminoid putrefaction (marsh gas, ammonia, hydrogen sulphide), as upon those more definitely due to carbohydrate fermentation—namely, lactic, butyric, or acetic acids; the latter two of which are volatile. For it is strange that hydrogen sulphide, for instance, is an uncommon finding in late cancer of the stomach, whereas in atonic conditions of a benign nature (whether primary or secondary to obstruction of the pylorus) it is by no means so rare. While this is not advanced as a rule in the differential diagnosis between cancer and the benign conditions, nevertheless, when the fermentation organic acids are absent or low in amounts, and those from albuminoid decomposition high, it is somewhat of an argument against cancer being the cause of the stagnant condition of the organ. On the other hand, when the organic acids are high, even if the putrefactive gases are also a marked feature, one would be led to view that content as most probably from a case of malignant disease. To briefly state my observations in this matter I would say, that where fermentation of gastric contents is increased, and gases found are those normally present in healthy stomachs, ulceration or irritative conditions of the organ, from any cause, are suggested; that when the organic acids are high with or without the putrefactive gases cancer is probably present; that when only the butyric or acetic acid is present in marked amounts, and the lactic decidedly less so or absent, or when just the putrefactive gases are the main feature of the stomach contents that only atony or bacterial increase can be diagnosed; and lastly, that when the intestine secretions are constantly present in the stomach and the putrefactive gases a feature intestinal stenosis from some cause is suggested.

Test for Gases.—To obtain a knowledge of the gases formed in the stomach during the process of digestion the gas-collecting apparatus of Hoppe-Seyler[15] may be used for direct extraction, or any form of gas-collecting fermentation-tube may be employed with the gastric contents. Among the latter forms of apparatus that are readily procurable are the Doremus ureometer and the Einhorn saccharometer—the first is the choice because of its larger size. The drawback to the use of these closed end tubes is, that with the exception of the carbon dioxide content in the chamber, it is quite difficult to extract the gases for estimating the presence of the volatile acids, hydrogen

sulphide, or marsh gas. For this reason, I have constructed a simple apparatus which is of larger caliber and shorter than the ureometer, and is not so complicated or impractical for clinical use as the laboratory forms of apparatus used in gas analysis. It also answers for the gas results obtained in the chemical and bacteriological examinations of feces, and will be found described on page 250. The unfiltered gastric contents are used which are first neutralized when HCl is present by a normal solution of sodium hydrate, the apparatus placed in the water-oven at 37° C. for twenty-four hours at which time the observation is made.

After many hundred examinations of test-meals from stomachs in which a normal or excess HCl secretion existed, it is surprising how uniformly low the gas results were found to be. In these instances one never meets with more than only a few small bubbles of gas, and I believe that 2 per cent. of gases may be taken as an extreme limit. In the acid form of chronic gastritis this may be somewhat higher, reaching in several instances to 6 and 8 per cent. In twenty-seven cases in which I believed gastric ulceration to be present (eleven of which proved to be so at operation, the rest not being operated upon) the gas content ranged from 4 to 27 per cent., with 11 per cent. as the mean average of them all. In all of these larger amounts of HCl secretion than is normally seen was present, it may here be remarked that about one-half of the cases of ulcer have a normal and even an absence of HCl secretion and in these the positive high gas results may be more definite. In hypoacidity, when the volatile acids are a prominent feature in the gastric contents (chronic gastritis); in the low forms of infective states; in the acute inflammatory conditions; and rarely in the irritative form of neuroses, the gas content was above 2 per cent. but generally not so high as in the ulcerated conditions. In my opinion, the higher the gas result with high HCl, the surer it is liable to be an ulcer case. In the marked stagnant states of the organ, the gas collection was the highest, usually over 10 per cent., and found in one of my cases of pyloric cancer to be 56 per cent.

ACETONE IN GASTRIC CONTENTS.

As a product of the decomposition of albuminoid bodies the acetones are found in gastric contents. Following v. Jaksch, Lorenz[16] repeatedly demonstrated acetone in the distillate of gastric contents, the quantity occasionally exceeding that found in the urine. In the presence of acetonuric conditions, like diabetes mellitus, the infectious fevers, or pregnancy, the acetones may be found in the stomach as an

excretion into that organ from the circulation, just the same (but not to the extent) that it is found in the urine, therefore in these conditions the presence of acetone in the stomach would not be so significant as in the primary diseases of the organ in which such may be found. In gastric contents the acetones are strongly suggestive of gastric dilatation, and as this condition is commonly observed in its highest degrees in cancer it possesses a diagnostic significance in that connection. On the other hand, acetone content may be met with in simple atony and the secondary forms following pyloric stenoses of a benign nature. I have occasionally observed it in marked states of stomach prolapse (probably because of the accompanying atony or for dynamic reasons due to change of form), but never in the clean cut gastric neuroses.

There are several tests for acetone that can be used for gastric filtrates or urines. The methods in which previous distillation are advisable (Lieben's, Gunning's) make them rather difficult for clinical work, and, because albuminoids are generally present in gastric contents and often in urine rather complicates the Dunniges test. The color tests of Frommer and of Legal answer sufficiently for practical purposes, and only these will be included.

Frommer's Test.—Ten cubic centimeters of gastric filtrate (or urine) are treated with 1 gramme of caustic soda, and immediately is added about 1 cubic centimeter of an alcoholic solution of salicylic aldehyde (1 to 10 of absolute alcohol). The mixture is quickly heated to just short of boiling point when, if acetone is present, a marked purple-red color results at the zone of contact with the alkali. If a caustic soda solution is used the fluid first becomes a yellow and goes through the colors red and purple to a deep carmine. This course of colors is best noted when the fluid is heated. For laboratory work the solution of the alkali is handiest.

Legal's Test.—This test is not as reliable as the above. It consists of adding to about 5 or 10 cubic centimeters of gastric filtrate (or urine), a few drops of a strong solution of sodium hydrate, at which the mixture assumes a red color which rapidly disappears, and in the presence of acetone is replaced by a purple or violet red when acetic acid is added.

NITROGEN IN GASTRIC CONTENTS.

The performing of the so-called Solomon test is of value in th early diagnosis of gastric cancer, but too much importance must no be placed upon negative results since even in late cancer it may no be present. The presence of nitrogen (or albumin) in the stomach a these times is due to transudation of blood serum or blood into th

empty stomach. To these ends the stomach is washed out in the evening, and on the following morning 400 cubic centimeters of normal salt solution is introduced into the organ and extracted after a short stay. The presence of more than 30 milligrammes of nitrogen, or a marked turbidity with the Esbach reagent (picric acid) is suggestive of cancer. Because of the simplicity of the Esbach method of testing the saline solution, and the complicity of the Kjeldahl method for quantitatively estimating nitrogen, the performing of the former is advised in routine clinical work. The Kjeldahl method is found described in Chapter IX, and answers for estimating nitrogen in gastric contents, urine, and feces (high albumin loss).

EXAMINATION OF THE FERMENTS OF THE GASTRIC JUICE AND THEIR ZYMOGENS.

The gastric juice as represented in the enzymotic content is a more reliable and important indicator of the functional power of the glandularis than is the hydrochloric acid. In my separate analyses of the enzymotic and acid contents of many test-meals, it can definitely be stated that most often both of these secretions are increased or lowered to a fairly equal extent, but that this is a rule that cannot be depended upon (excepting possibly in atrophic conditions of the glandulature) when employing only the quantitative acid analyses for estimating stomach secreting power there is no doubt. In the irritative conditions of the stomach both secretions are usually high together, but when for emotional or psychic reasons the acid secretion is high, the enzymotic may be normal or low; or again, the acid may be low and the pro-enzymes present in normal amounts. In gastritis acida, the hydrochloric acid may be high and the enzymotic content low. It is also well known that in anomalies of menstruation, in congestive conditions, and in acute and early chronic gastritis, the hydrochloric acid secretion may be low or absent and the secretion of gastric pro-enzymes normal or but slightly changed. It must thus be plain that in diagnostic, therapeutic, and prognostic ways, the more specific secretion of the gastric juice (the pro-enzymes) are more important indicators of organic change in the secreting apparatus of the stomach than is the acid, and for these reasons the performing of quantitative as well as qualitative tests is essential. As the qualitative tests are comprised in the quantitative estimation only the latter will be considered.

Pepsin and Pepsinogen.—According to the many observations that have been made, all of the ferments of the stomach are secreted

as pro-enzymes, and that pepsinogen, or pro-pepsin, is transformed into the active pepsin by the free hydrochloric acid of the gastric juice. This ferment activity is destroyed or inhibited by the addition of the alkaline carbonates, and, when the pepsin is in solution, by a temperature of 70° C. It is to-day conclusively settled that free hydrochloric acid is the acid *par excellence* for rendering active this pro-enzyme, and that while other acids (sulphuric, lactic, acetic, etc.) can activate pro-pepsin, much larger quantities of them than the hydrochloric are necessary and that the activity thus produced is not so prompt or perfect.

Under normal conditions 25 cubic centimeters of gastric juice will dissolve 0.05 gramme of serum albumin in one hour, the same amount of coagulated egg albumin in three hours, and a like amount of fibrin in one hour and a half. Since the reduction of the albuminoids to absorbable peptones is pepsin's specific action, and this is manifested to a complete degree and time in the above mentioned substances and amounts a standard has been formed for noting the enzymotic power of gastric filtrate. It must be plain, however, that pepsin so delivered from the stomach and tested without it is a far different matter from pepsin active within the stomach during the complex process of digestion in the organ, and thus laboratory estimations (when free HCl is sufficient to activate all of the pro-pepsin present) should always be considered as somewhat lower than the actual conversion power present in the stomach from which it was drawn. But when the HCl secretion is low, the addition of an acid to the filtrate may activate more pepsin without than actually occurs within the body. For these reasons, we must be satisfied with approximate estimations, which, when carefully performed, are accurate enough for clinical purposes. It must be remembered that indifference in measuring and weighing the quantity of Ewald meal ingested—particularly the water—and the time of its removal could cause much variation in the quantitative estimations of the enzymes. Also, that tubes used for the extraction of these test-meals should not contain any excess of water or lubricating fluid, and that the vessels used in the examinations should be dry.

Mett's Method.—Satisfactory comparative results can be obtained by the use of the Mett method, which, by careful technique, is surprisingly accurate even in the face of the complex character of inhibitory factors usually present. As a quantitative and qualitative method it is much superior to the use of the customary albumin disks, firstly, because the tubes are easy to prepare and keep for a long time, and secondly, for the more definite results easy to be obtained.

For the purpose, several tubes about a foot long, 1 to 1.5 millimeters in caliber, and with thick walls, are secured, and the whites of several eggs are thoroughly mixed so as to obtain a homogeneous fluid. By mouth suction, the tubes are filled with egg albumin, care being taken that no air bubbles are contained, and the ends plugged with little balls of moistened bread. When the tubes are filled, they are dropped into a long, flat pan containing an inch or so of warm water which is now rapidly brought to a boil and which temperature is maintained for five minutes to obtain complete coagulation. After drying, the tubes are hermetically sealed with sealing wax or paraffin, and laid away for several days, or until the first seen fine bubbles disappear. When needed for use, these tube lengths are cut into sections 3 centimeters or 4 centimeters in length (by means of a triangular file and broken), and only such sections used as have an accurate fraction of both albumin and tube, and not showing the presence of bubbles.

For the routine of estimations we employ the undiluted gastric filtrate (15 cubic centimeters or less), a dilution of one-fourth (4 cubic centimeters to 12 cubic centimeters), and a dilution of one-sixteenth (1 cubic centimeter of filtrate to 15 cubic centimeters of one-twentieth normal HCl solution); the last dilution is used for quantitative estimation. Each one of these is placed in a covered dish of the Stender type with two Mett tubes, and the specimens allowed to digest in the water-oven (at 37° C.) for twenty-four hours. At the end of this period, the tubes are taken out of each dish, the four ends of albumin loss measured by means of a pair of calipers, and an average reading calculated for each specimen. The relative amount of pepsin is then obtained by squaring the result; this in terms of millimeters raised to the square and multiplied by 16 (the degree of last dilution) indicates the relative amount of pepsin. Should it be seen that but little albumin (0.5 millimeter) remains in the last tube the gastric juice must be diluted thirty-two times. The unit of measure is the amount of pepsin by which 1 millimeter of albumin is digested in twenty-four hours with an acidity of 0.18 per cent. of HCl. A magnifying lens and a vernier measuring 0.1 millimeter or a low-power microscope with a stage micrometer are very convenient. In measuring, one end of the tube is placed against one jaw of the calipers, and the other jaw is separated until its edge is just visible through the opalescent edge of the albumin. If the tube had broken obliquely the shortest side is taken, while if the albumin is uneven the highest point to which digestion has reached is measured.

Hammerschlag's Method.—This is more easily performed than the above, and answers well as relative method for routine work.

When, however, a diagnosis is somewhat in doubt, either one or the other two methods described is preferable.

Two Esbach tubes (albuminometers) are employed. Tube A is filled to the mark U with a mixture of 10 cubic centimeters of a 1-per-cent. solution of egg albumin in a 0.4-per-cent. of hydrochloric acid, and 5 cubic centimeters of gastric filtrate. (The 1-per-cent.-solution of egg albumin is made by diluting egg albumin in thirteen times as much water). The second tube B receives a mixture of the same solution without the gastric filtrate but 5 cubic centimeters of water instead. Both tubes are put into the water-oven and kept there at a temperature of 37° C. for one hour, after which they are taken out and Esbach's picric acid reagent is added to each tube to the mark R. The tubes are corked, inverted three or four times to insure thorough mixing, and after standing for twenty-four hours the amount of precipitated albumin is read off in each. The difference indicates the amount of albumin which was digested, and this raised to the square gives the amount of pepsin present. The principle of the method is, that such albumin as the pepsin has converted into peptone is not coagulated by the picric acid.

Jakoby-Solms Method.—The recently advanced ricin test, according to Jakoby and Solms[17], is performed as follows; 1.0 gramme of ricin is dissolved in 100 cubic centimeters of a 5-per-cent. sodium chloride solution and filtered. Two cubic centimeters of this solution are placed in a small test tube, to which first 0.5 cubic centimeter of decinormal HCl solution and then 1 cubic centimeter of diluted gastric filtrate are added. A ricin deposit takes place, which when the tube is placed in a water-oven for three hours at 37° C. is cleared by the ferments present. For the purpose of a standard for quantitative estimation, Solms designates that the amount of gastric juice which is just sufficient to entirely clear up the 2 cubic centimeters of ricin solution (when the test is performed as above mentioned) is one pepsin unit, and that normally stomach contents contain about 100 pepsin units to the cubic centimeter of gastric juice.

For the purpose of making a quantitative estimation the gastric filtrate may be diluted 10, 20, 40 and 100 times, and 1 cubic centimeter of each of these dilutions is placed with the above mentioned amounts of ricin, sodium chloride, and decinormal HCl solutions in small test tubes appropriately marked. At the end of three hours these tubes are taken from the water-oven, and the amount of ricin deposit noted according to the dilutions in each tube. Normally, the deposit has disappeared in the dilutions 10 and 20, and if a deposit is noted in these tubes the pepsin may be considered as diminished, and

in excess when absent in dilution 40 or above. In states of low gastric juice secretion the use of the filtrate itself, or only a dilution of 2 or 5 times, may be necessary for the estimations.

The technique as advanced by Jakoby and Solms is as follows: The filtrate of the Ewald meal being employed, the total acidity and the free hydrochloric acid are first determined and the dilutions made according to the degree of acidity. In hyperacidity, dilutions of 1 to 100 or 1 to 10,000; and in hypoacidity, from 1 to 10 to 1 to 100. The estimation is made by means of five test tubes, to each of which had been added 2 cubic centimeters of the filtered ricin solution, and 0.5 cubic centimeter of a decinormal HCl solution. To the first tube is added 1 cubic centimeter of boiled gastric filtrate (the peptic activity of the gastric juice is destroyed by boiling); to the second is added 0.9 cubic centimeter; to the third 0.8 cubic centimeter; to the fourth 0.5 cubic centimeter; and none to the fifth. The gastric juice whose peptic activity is to be tested is then diluted with distilled water in the proportion of 1 to 100, and added to the tubes as follows:—

To tube No. 1, none; to No. 2, 0.1 cubic centimeter; to No. 3, 0.2 cubic centimeter; to No. 4, 0.5 cubic centimeter; and to No. 5, 1 cubic centimeter. Each tube then contains 3.5 cubic centimeters of fluid. The tubes are corked, placed in a water-oven (at 37° C.) for three hours, and the sediment observations made. The denominator of the fraction of dilution divided by the number of cubic centimeters of diluted contents required to clear the solution expresses the peptic activity of the gastric juice that is being examined. Thus, if with the dilution of 1 to 100, 1 cubic centimeter clears the solution the peptic activity is expressed as being equivalent to 100; if 0.5 cubic centimeter of the gastric filtrate diluted to 1 to 100 is sufficient to clear it, the peptic activity is 200. Accepting as the peptic activity of juice from normal stomachs as 100 units, Solms reports that in subacidity the peptic activity varied between 10 and 20 units; in hyperacidity from 100 to 1000; that hyperacidity was not always accompanied with correspondingly high enzymotic content; that in gastric ulcer the units were high; and in cancer of the stomach or gall-bladder and pernicious anemia they were greatly reduced below 100.

This method answers fairly well for quantitative estimations, but for accurate analysis is not to be preferred to the older Mett method which in my hands is more steadily accurate. The main reason for this is that the more pepsin present in each of the tubes the more rapid is the disappearance of the sediment of ricin, and that when in the high dilutions, or low (when but little enzyme is present), three hours is not time enough to make differences with the deposited ricin,

and that in slow digestion some inhibitory chemical change affecting the activity of the enzyme and thus the results of the test takes place. For instance, it is not uncommon to observe with filtrates from normal stomachs that the one-tenth dilution may show no deposit, and the variation between 20, 40, and 100 to be distinctly more than these dilutions should signify.

Einhorn[18] has advanced an apparatus for the performance of this test which does away with the necessity of the water-oven, consumes less time, and to which the test tubes used are graduated in millimeters to note the amount of deposit. The quantitative results from its use, however, are still more variable than those of the original method.

Chymosin and Chymosinogen.—In clinical work when the acid-pepsin secretion is normal or high it is surprising how accurate the secretion of this enzyme corresponds with that of the proteolytic ferment (and it is mainly for this reason that I doubt that there is a specific milk curdling ferment). But in diseased conditions of the stomach and that of general illness much variety is observed as with pepsin. The three main digestive secretions of the stomach, namely, hydrochloric acid, pepsin (and chymosin), are liable to show this ratio change in ways suggesting that the HCl secretion is the most easily, quickly, or markedly affected, with pepsinogen (pepsin) somewhat less so. Because of the ready sensitiveness of the HCl secretion to changes in corporeal conditions (as well as gastric), quantitative changes in the acid are not of as much diagnostic significance in gastric conditions as is that of the enzyme, and thus the ferment is a truer index of stomach disease than is HCl, although for thorough work both should be quantitatively tested in each instance. It is not uncommon [illegible] particularly in some of the mysterious neurotic conditions [illegible] in which but little thorough pepto-[illegible] show a full quota of the milk curd-[illegible] test-meals removed a short time after-[illegible] be normal. On the other hand, in organic diseases [illegible] a loss or a shortage in the milk curd-[illegible] loss in the other more sensitive [illegible] tests of this possess much value [illegible] disease, and it is fortunate [illegible]

[illegible] upon milk, the [illegible] to observe that while [illegible] stomach this enzyme is [illegible] free HCl serves to [illegible] be used in a neutral or

alkaline media when any one of the soluble calcium salts had been added. For this reason, tests for this power of pepsin are of decided value in alkaline vomitus, and where we may wish to note whether this contains constituents of the gastric juice or not.

Qualitative Test.—Five or ten cubic centimeters of milk are treated with a few drops of gastric filtrate and kept in a water-oven at 37°, or the tube placed in a glass of warm water for 15 minutes. If coagulation takes place the enzyme is present. If not, the milk is treated with 10 cubic centimeters of feebly alkalinized gastric filtrate (rendered so by adding sodium hydrate, or sodium carbonate solution and testing with red litmus paper), and 2 or 3 cubic centimeters of a 1-per-cent. solution of calcium chloride are added. This is put through the same heating process as above mentioned, and in the presence of the zymogen a thick cake of casein will occur.

Quantitative Method.—The method is based upon the fact that on gradually diluting the gastric filtrate an extent of dilution is finally reached at which the curdling reaction is no longer obtained. Under normal conditions this for the ferment is between 1 to 30 and 1 to 40, and for the artificially activated proferment between 1 to 100 and 1 to 150. In making an analysis of the ferment the gastric juice is neutralized with a very dilute solution of sodium hydrate (the decinormal solution answers well), and 5 cubic centimeters of the filtrate is placed in each of several tubes. The first is employed without dilution, the second diluted 10 times, the third 20 times, and the fourth 30 times, with water. To these an equal amount of neutral milk is added corresponding to the total amount of the gastric juice, or gastric juice dilution in the various tubes. These tubes, properly labeled, are placed in the water-oven and kept for 15 minutes at a temperature of 37° C. and the degree of dilution noted at which the coagulation occurs. Because in the high dilutions much fluid is contained in the tubes it is best to perform the test by placing 5 cubic centimeters of milk in each of several tubes, and to this add the neutralized pure juice, and the various dilutions in 5 cubic centimeter amounts; in this way all of the tubes have the same quantity of admixture.

Since with a gastric filtrate on hand one cannot foretell the results of the reaction, and should it be found that the end reaction is present only in the pure juice or a low dilution (and would require the performance of the test over again), it is best to activate all of the ferment substance in the first instance in each quantitative analysis. For this reason I would advise the following as the steady routine for the estimations. In 5-cubic-centimeter lots, the pure juice and up to the 140 dilutions be placed in the various tubes. To each of these are

added 5 cubic centimeters of neutralized milk and 3 cubic centimeters of a 1-per-cent. sodium chloride solution, and the observation made as above described. Where steady work with gastric filtrates is being performed, I would advise the use of a simply constructed test-tube stand to hold eight tubes of about 15 or 20 cubic centimeters capacity. The tubes themselves can be permanently marked with diamond ink, or the base of the stand labeled to correspond to the dilatations in each tube. Such a stand can be used in an oven and is most convenient.

Lipase.—It is now definitely settled that lipase is a normal constituent of the gastric juice. Being present in such small amounts in the stomach contents and the difficulties encountered in accurately estimating it quantitatively, places the tests for it in subordinate value to the pepsin, and the hydrochloric acid estimations. In instances in which a milk or a diet liberal in fats may be indicated in individuals who claim or complain of an intolerance for these substances, tests for lipase may be performed. After an experience with several of such persons (in all of whom I have found lipase always present), I have grown to believe that where this intolerance really exists, it is due to the mechanical effects of tough milk curds or fat on the pylorus and stomach, and not to an absence or diminution of the fat-splitting ferment. In achylic conditions the gastric lipase content falls with the other stomach digestive secretions, but it is not uncommon to see a relatively higher lipase content than would be represented by the other gastric secretions. This has always represented to me a lipase addition by regurgitation from the duodenum (such as may be possible with disturbance of the pyloric reflex in the neurotic or secretory conditions, or possibly in the direct way from primary or secondary atony of the pyloric bundle of muscle fibers). The demonstration and quantitative estimation of lipase have already been described in this chapter. To be sure that such lipase as may be present is from the stomach itself, it is essential that a thorough washing of the organ be performed, and the test-meal following it is free from fat (the lactic acid free meal of Boas answers well).

EXAMINATION AND SIGNIFICANCE OF GASTRIC MUCUS.

The mucus in test-meals is found both incorporated with the substance of the meal and a free form which swims in substance or gassy clumps on the top of the fluid. The first is the gastric mucus which had been secreted by the glandulature of the stomach combined with the mucin constituent of the saliva, and the second the secretion from the mouth or pharynx incident to the passage of the stomach tube.

The latter can be recognized with the naked eye, and since it is of no significance in diagnosis it should be skimmed off.

Test-meals from normal stomachs contain too small amounts of mucus to recognize its presence by the naked eye, excepting by a degree of viscidity it imparts to the return. From such meals a glass rod can be drawn quite clean of adhered substance, although it is usual that more amylum adheres to the rod than from meals pathologically deprived of a normal amount of mucus content. In the majority of cases of chronic gastritis the glass rod can drag up a string or clump of incorporated mucus, whereas in cases of increased HCl secretion and in complete atrophic gastritis the meal is often so fluid that the rod is delivered clean, not only of mucus but also of the carbohydrate test-meal substance. Unless such as are enumerated above are plainly evident, no fixed conclusions of diagnostic import can be drawn from observations on the macroscopic examinations of mucus alone, for cases of more or less atrophic or sthenic gastritis for instance may display an increased mucus, and others again a very low content; and this is likewisely true of ulcer, cancer, and the benign affections.

ANALYSIS OF PRODUCTS OF ALBUMINOUS DIGESTION.

Since proteid conversion depends upon the presence of hydrochloric acid and pepsinogen, tests for the various proteid bodies are not important in clinical work and because the various proteid bodies are present in more or less complex mixture and the tests for each of them comprises much laboratory detail, these tests are but rarely performed. Qualitative tests for syntonin, pro-peptone, and peptone, are found on page 41, and separation of the various albumoses may be performed as follows:—

A known amount of the gastric filtrate is carefully neutralized with a dilute solution of sodium hydrate, at which the syntonin present will be precipitated. The specimen is filtered and the deposit on the filter paper with the paper itself (which had previously been dried and weighed) is tested, or dried and weighed; this gives the amount of syntonin. The filtrate is then rendered feebly acid with dilute acetic acid, treated with an equal volume of a saturated solution of common salt, and brought to a boil, at which the native albumin present will be coagulated and can be filtered off on cooling. This deposit on the filter paper is weighed, as before described, and gives the amount of native albumin present. The next step is to obtain the albumoses and peptones that remain in the filtrate. The albumoses are obtained by treating the filtrate with a concentrated neutral

ammonium sulphate in excess and permitting it to stand for twenty-four hours at which full precipitation of the albumoses takes place. When these have been filtered off, the filtrate contains the peptones, which can be demonstrated by the addition, drop by drop, of a 2-per-cent. solution of cupric sulphate, at which a rose or a purplish-red color will develop (biuret test).

ANALYSIS OF PRODUCTS OF CARBOHYDRATE DIGESTION.

The test for the degree of starch conversion is not of much help in the diagnostic way. The main reason of this is that all types of these bodies from starch to sugar are usually present causing a complex color. In absence or diminution of salivary secretion, the blue color with iodine may be most helpful in suggesting these states, and a very light-yellow might suggest a low acid-enzymotic secretion in the stomach. An occasional suspicion of hasty eating and incomplete salivation as being a factor in the production of gastric distress may be obtained by these tests.

The various stages through which starch passes to the end sugars are demonstrable by the different colors in starch and erythrodextrin, and absence of color in achroödextrin and the sugars, that are noted when such substances are treated with a solution of iodopotassic iodide (Lugol's solution). With hydrated starch this strikes a blue, and with erythrodextrin a mahogany brown. Maltose and dextrose are best tested for by means of Fehling's or Nylander's solution.

To note the status of starch digestion a few cubic centimeters of gastric filtrate is placed in a dish, diluted with water and a drop of Lugol solution is permitted to run down the side of the vessel into it. Filtrates from normal stomachs usually display a dark-brown coloration; and when the starch conversion has been low, a deeper brown with a bluish tinge may be noted. A deep yellow or light brown always suggests a high conversion.

TESTS OF THE MOTILITY OF THE STOMACH.

A knowledge of the motor condition of the stomach is of vast importance in the diagnosis and therapeutics of gastric disease. Of the causes of insufficiency two main divisions may be made, firstly, a weakness of the expelling force; and secondly, an obstruction to the emptying of the organ.

In the first of these may be mentioned as factors in its production the gastric causes, prolapse, habitual overeating and drinking, malignant ulcer, organic disease affecting the body of the organ, long standing neurotic conditions, etc., and the constitutional causes of toxemias, particularly from systemic disease or that of other special organs than the stomach, and lastly debilitated states of the body.

The various conditions in which mechanical obstruction to the exit of chyme exists may be divided into the gastric and the extragastric causes, in both of which the obstruction may be situated in the pyloric region or at the pylorus itself. Among the conditions confined to the stomach can be mentioned carcinoma, cicatricial contraction following ulcerated conditions, thickening of the pyloric musculature in hypertrophic gastritis, perigastric bands; pedunculated, benign growths in the cavity of the stomach encroaching on the narrow pyloric region; lymphocicatricial masses (following ulcer), usually beginning in the deep layers and extending beyond the organ and by virtue of its size pressing the pyloric region forward, and lastly a congenitally narrow pylorus. Among the extragastric conditions may be enumerated tumors near the pylorus involving the gall-bladder, liver, small and large intestine, pancreas, kidney, large or displaced spleen, herniæ, volvulus, etc.

Test-Meals and the Chemical Methods.—Repeated investigations have proven to me that the motor function of the stomach is best tested by means of foods which in kinds and quantities should leave the stomach in certain lengths of time—namely, by means of test-meals. As compared to the various chemical measures in which the great uncertainties of time of dissolving, absorption, and excretion of the ingested substances in the urine and saliva are encountered, the test-meal methods are the direct, more accurate, and truer physiological means.

In the efforts to get away from the unpleasant features of the use of the stomach tube, various observers, taking advantage of the fact that certain chemical substances dissolve or are split up in alkaline medias and not in acid, have advanced methods for testing the motility of the stomach that are so far removed from physiological lines that the use of them all should be discouraged. For this it is sufficient to recall that catgut, with which the Sahli bag is tied, may dissolve in the small intestine as well as in the stomach.

In the ingestion of chemical substances, which should be absorbed from the alkaline small intestine and not from the acid stomach, as a means for testing the stomach motility just as much inaccuracy may exist. It has long been taught that digestion in the stomach is accom-

plished solely by the gastric and mouth secretions, and that only in pathological states could bile, succus entericus, and pancreatic juice be present. Parlow, however, has called attention to the possibility of pancreatic digestion in the normal stomach, especially after the introduction of oils. According to Boldyreff[19], under certain conditions, considerable amounts of pancreatic secretion together with bile and intestinal secretion make their way into the stomach and are concerned in the activity of gastric digestion. In some of the many aspirations of the morning empty stomach I have performed in the search for organic elements in gastric contents, the presence of the intestinal secretions were not rare findings even in non-pathological conditions of the organ. In the low secretory and particularly in atonic conditions (both of which comprise the great majority of gastric cases), such morning findings were not uncommon, and in my opinion enough attention has not been given to this fact, which, as Boldyreff has said, is not occasioned by chance reversed peristalsis from the bowel; here then is one element of inaccuracy to the chemical methods of noting the gastric motility. Added to it, are those connected with the "package methods" already mentioned, the circuitous route these chemical substances must take before elimination, and the presence of pathological conditions affecting absorption from the intestines in the first instance, or elimination from the delivering organs in the last. These are my reasons why the salol, iodoform, methylene blue, iodipin, or other methods, are not included or advised for use, since the line between gastric and intestinal digestive processes is not sharp enough to warrant accurate deductions from their use in the tests for HCl secretion, or the absorptive and motor tests.

The significant factors pertaining to the diagnoses of the common conditions of motor disturbances of the stomach, as gleaned from the examination of test-meals, can be found in connection with the description of the different forms of test-meal (Chapter VI), the macroscopic and the microscopic examinations of same, found at the beginning and conclusion of this chapter.

Food Remnants Obtained by Means of Morning Lavage of Meals Taken the Evening Before.—For the purpose of distinguishing in cases of dilated stomachs whether the dilatation present was secondary to pyloric stenosis or primary in nature, the lavage of the morning stomach after a heavy meal taken the night before has been practiced for years. In high degrees of pyloric stenosis the morning stomach usually contains more or less food remnants, usually those of the indigestible vegetable substances (skins, seeds, etc.), whereas on the other hand, when the exit of the stomach is patent, in even high

degrees of gastric atony the morning stomach is empty of foods. This method of examination must be considered in the same light for diagnosis as an eight, nine, ten and so on hour extraction of a mixed meal. Nothing takes place in digestion during the night, or sleep, or the recumbent position of the body that makes the method any more valuable than the same kind of a meal taken and the stomach washed both on the same day. Its utilization, however, has phases of convenience that makes its consideration well worth the while. When the examination of the Ewald and mixed meal shows the existence of a stagnant condition of the organ of a high degree, rather than extract a series of mixed meals at, say, the eighth, tenth and twelfth-hour intervals, it expedites matters to advise the taking of a dinner consisting of the various commonly eaten food articles at eight or ten P.M., and the lavaging of the organ in the morning at, say, eight, ten, or twelve hours afterward.

It must be evident, that in a high degree of stagnant condition of the stomach gastric distress incurred by the taking of such a heavy meal, or the vomiting of it that is liable to follow when its fermentation and irritation take place, is very apt to cause the patient a restless and sleepless night, or the vomiting of the meal before the morning. For these reasons it has been my custom to control the quantity of food taken and advise the ingestion of the regular Riegel meal in the evening at ten, or, better yet, to employ only such substances for the evening meal as, by virtue of their high cellulose character, are not digested and thus would "drag" in the stomach, and still would pass through a stomach tube in washing for them; for these examinations I have now limited my practice to the use of prunes, or raisins (cooked or raw). A small dish of these articles can be eaten in the evening at a specified time and the skins and cellulose substance of them readily obtained in the morning. In the examination of the lavage water in these instances the employment of the author's straining sieve, described on page 380, is convenient.

A word of caution must now be said on decreeing conclusions for or against pyloric stenosis from these examinations alone, which, next to "late collective vomiting" may be classed as the most valuable measures we now have for the diagnosis of stenotic conditions. The perusal of the following history of a case in point is offered as of interest:—

CASE OF DR. J. B. BISSELL.—G. S. R., 48 years. Intelligent man. Writer by profession. Widower. Mother died at 66, of pneumonia; father at 71, from an "accident." Habits good. Highly neurotic in nature.

History.—Twenty-five years before, when weighing 180 pounds, began with

pains in the stomach-region of a gastralgic type. The attacks came on periodically, lasting one or two weeks at a time, with an interval of complete cessation between. During the attacks the pain was most acute (requiring morphine), and was accompanied with vomiting and much gaseous distention of the stomach. His weight gradually ran down to 150 pounds until one and one-half years before I saw him when he contracted typhoid fever. After the typhoid his gastric attacks came more often and more intense in character; he had distinct collective vomiting, sometimes vomiting foods eaten two days before, and as much as two quarts at a time. At times he vomited very seldom—"Providing I was not nervous at the time when I would be seized with a violent pain in the stomach during a meal, I would get these attacks for no known reason and when begun I would be worse again for two or three weeks." In the past one and one-half years, lost 68 pounds in weight, and once lost eight pounds in ten days. For a space of three months since the typhoid he improved marvelously and regained 40 pounds of lost weight, only to lose it again afterwards. Carried a stomach-tube in his pocket which he passed upon himself to empty his stomach and relieve his gastric distress during the painful seizures. Was mildly addicted to the use of morphine.

Physical Examination.—Weight, 108 pounds; anemic and attenuated in body; plainly a neurasthenic. Stomach seven centimeters below umbilicus and enlarged in all directions; gastric peristaltic waves plainly visible; gastric splash sounds marked; an indistinctly-defined mass, small in size and situated deep in the epigastrium; pressure on the epigastrium painful, and gave him nausea. Ewald meal showed 180 cubic centimeters return, a low carbohydrate conversion, a high HCl secretion and a total acidity of 140°, and increased mucus. He ate a large dish of prunes and raisins at ten o'clock in the evening, and the stomach was washed the next morning at 9 o'clock. The lavage water contained nothing but a few rolls of mucus (no vegetable substance whatever).

Operation the next day. The anterior surface of the pyloric region and stomach-body normal. No metastases or adhesions. A mass about the size of a child's fist was disclosed back of the pyloric region, pressing both walls of the pyloric region forward, but not actually involving the pylorus itself. Its deep situation precluded its extirpation, a gastro-enterostomy being performed with successful results in the patient's local and general improvement.

The above case shows that a stenotic condition must be very marked at or very near to the pylorus itself to give results from this method of examination. I have observed two cases of perigastric bands binding down the pyloric region (when the stomach was also immensely dilated) that failed to give results from this method of examination, and thus it is that one should be careful not to be too hasty in decreeing the absence of stenosis from negative returns.

Roentgen Ray—Mixed Meal Method of the Author.—In cases in which the use of the stomach tube is contra-indicated, refused, or when for any reason we wish to avoid its use, a new method of noting the motility of the stomach is here advanced. The method is based upon the fact that the insoluble bismuth salts leave the stomach with the component foods of the Riegel meal—or any mixture of foods in fact —in about normal times. In normal stomachs and under favorable

conditions about 25 grammes of bismuth subcarbonate or 32 grammes of bismuth subnitrate ingested at the time of the taking of a Riegel meal and the stomach observed by X-rays five hours afterward, will just about show a shadow corresponding in limits of the upper and lower border of the pyloric region, while the body and fundus of the stomach will not cast a bismuth shadow. At six hours and later, the stomach will be emptied of both the bismuth and the food contents and the stomach area will not be discernible.

The method is simply performed. In the morning preferably, a Riegel meal is taken quickly followed by a glass of kephyr, zoolac, or kumiss, or a plate of apple sauce in which the bismuth salt had been mixed. The observation by means of the Crookes tube and fluoroscope screen, or X-ray plate, is made at three, five, seven and so on hours afterward, and the time noted when the bismuth has left the organ.

When the bismuth in the small intestine does not interfere with the observations, it may be noted that a stomach shadow may not be noted in three hours in cases of hypermotility, be distinctly marked in seven and nine hours afterward in delayed motility from any cause, and in marked pyloric stenosis it is usual to observe a deep general stomach shadow as late as twelve or more hours after ingestion. In one of my cases of a high degree of malignant stenosis of the pylorus, the stomach shadow could easily be noted three days afterward and for two days longer even in the face of two washings of the organ.

MICROSCOPIC EXAMINATION OF THE GASTRIC CONTENTS.

The microscopic examination of the stomach contents often gives most valuable diagnostic information. The findings of importance are the abnormal constituents in the fluid of the fasting stomach, the alterations in the normal conversion of foods during the process of digestion, and the bacteriological findings in both the food-digesting and empty organ. Much of the information on these has been described elsewhere in this volume, and this section will concern itself more particularly with the technique of the examinations.

Mucus.—The fluid obtained from the fasting stomach is usually food-free, consisting mostly of mucus, squamous detached cells from above the cardia, leucocytes, free nuclei which are derived from the normal cellular elements the protoplasm of which had digested down to the more resisting nuclear membrane, and occasionally the so-called mucus spirals. All of these may be readily recognized with a

low power, and, excepting the free nuclei, without the addition of a stain. A preparatory staining may be advantageous at times, and for this any of the commonly used ones may be employed. When much mucus is present, it is often best not to fix the slide with heat but to do this with plain wood alcohol.

If gastric juice containing mucus, hydrochloric acid, or large amounts of yeast fungi be permitted to stand for a while, small tapioca-like bodies will collect on the bottom of the vessel, which, upon microscopic examination, will be seen to contain numerous spherical

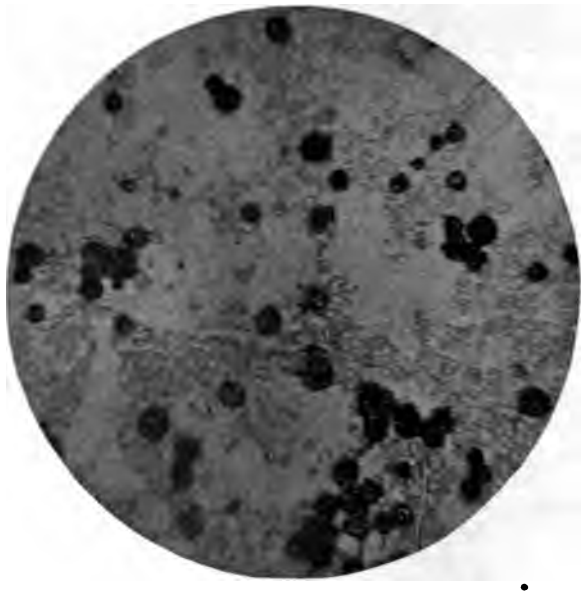


Fig. 36.—Photomicrograph of the contents of a fasting stomach showing marked growth of the yeast fungi and mucus spirals. Stained with aqueous eosine. × 900.

snail-like formations of mucus occurring either singly or collected in clumps. They are of no special pathological significance. Mucus itself can be recognized through the microscope by its fibril character and having corpuscular elements and myelin drops in the substance. The myelin drops are not stained by the dyes. Mucus is dissolved by alkalies, and not by acetic acid.

Cellular Elements.—In atrophying conditions of the glandulature, in addition to the above, the morning stomach often contains free cellular elements from the gastric tubules. These are obtained in the aspirated contents, or from saline instillations into the stomach, and

are of much value in diagnosing atrophic gastritis. When present in these conditions, the acid or parietal tubule cell is the more easily recognized because its entire protoplasmic body stains with a fine stippling of granules and its nucleus is prominent. The central cells are not so prominent because they take up the aniline stains but very poorly (with the nucleus of them better results are obtained). By patient search, however, their long oval nucleus with a more or less distinctly seen shred of cell protoplasm—not stippled—may be seen.

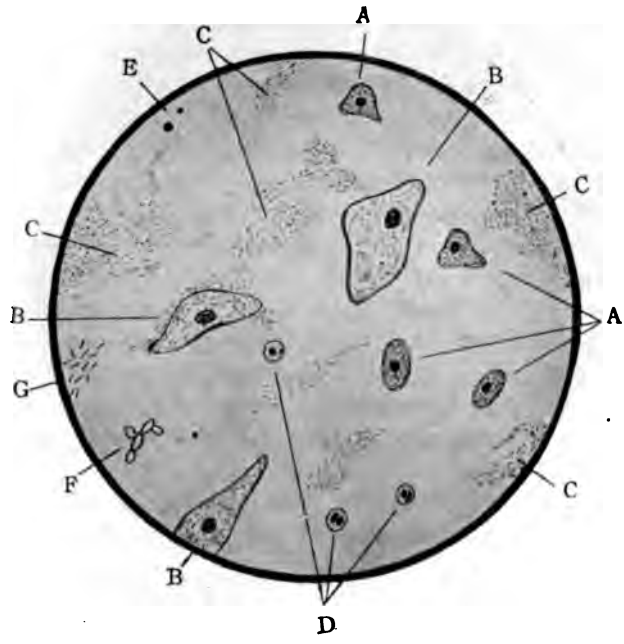


Fig. 37.—View through the microscope of the sediment from a case of atrophic gastritis. *A*, Acid or parietal cells. *B*, Squamous epithelium. *C*, Mucus from stomach. *D*, Leucocytes. *E*, Free nuclei. *F*, Yeast fungi. *G*, Bacilli. × 460.

In atrophic gastritis the epithelium of the stomach is also shed, and the columnar cells may show themselves singly or a number of them in regular alignment. Other cellular elements commonly seen in chronic gastritis are large numbers of leucocytes which can be readily recognized by their cellular and nuclear characteristics. In these conditions also the number of free nuclei are prominent features of the contents. Occasionally, a cellular cast of the gastric tubules may be seen with the cells in regular mass formation. Goblet cells from the

epithelium are not rare findings, and are not of much significance alone unless present in distinctly increased numbers. Care must be taken that the columnar cells observed and considered gastric are not those from the respiratory tract which have been swallowed; these latter can often be recognized by their cilia and subcilia protoplasm and infrequency.

When the instillation method is being employed, the return must be allowed to settle and the lower regions centrifuged. Several differ-

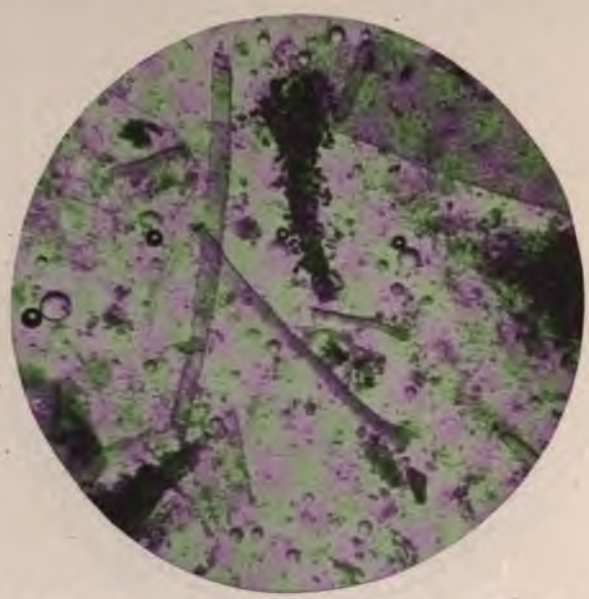


Fig. 38.—Photomicrograph of a portion of a dinner from a case of marked primary gastric atony extracted several hours after ingestion. Shows mostly vegetable substance, fat droplets, meat fibers, and amorphous material. × 70.

ent methods of staining may be employed, but the commonly employed one for staining blood and tissues answers best—eosin ½ per cent. or 1 per cent. alcoholic (wood) and hematoxylin (Bohmers). The slide is fixed by heat (when dry, passing through the flame three times), or when dry by flooding with wood alcohol and thoroughly drying. The eosin is used first for two or three minutes, the slide then swilled in water, and stained when wet with the hematoxylin solution. This method of staining usually colors the acid cells red, and the central and epithelial, as well as all others, a blue. Biondi's polychrome, aniline, gentian-violet, or others, may be used to bring the cells out prominently. An amplification of about 500 diameters is desirable.

Food Remnants.—These are obtained by direct aspiration, or better by lavage of the stomach a definite number of hours after a meal when the stomach should be empty or only a few stray remnants obtained. By the lavage method most of the larger particles would be collected on the surface of a sieving screen (if this is between 60 to 100 wires to the inch), and could be readily seen by the naked eye.

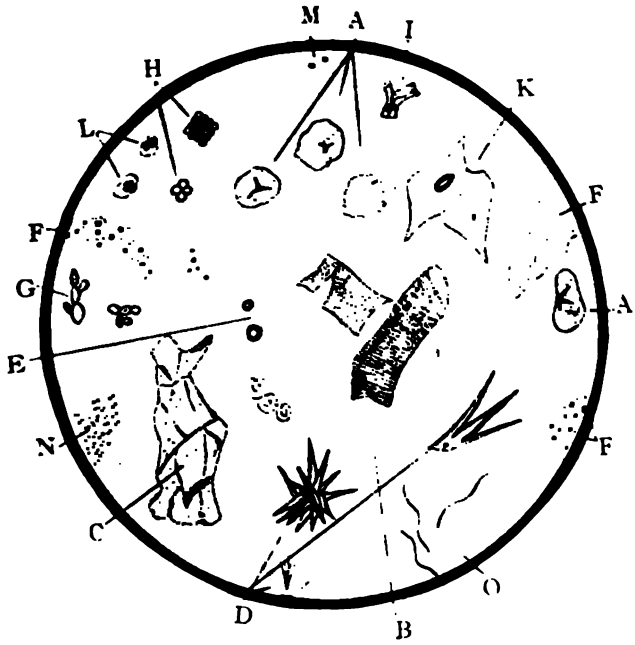


Fig. 39.—Microscope view of a part of the contents of a stomach from a case of extreme gastric myasthenia following typhoid fever. The picture represents particles of a dinner taken six hours before and an Ewald test-meal taken one hour before. *A*, Starch granules in various stages of digestion. *B*, Striated meat fibres (beef). *C*, Vegetable substance. *D*, Fatty acid crystals. *E*, Fat droplets. *F*, Mucus and mycelia. *G*, Yeast fungi. *H*, Sarcinæ. *I*, Columnar cells from pharynx. *K*, Squamous epithelium. *L*, Leucocytes. *M*, Isolated nuclei. *N*, Diplococci. *O*, Leptothrix buccalis. × 400.

When this is not used, or the particles very few or fine, the lavage return should be permitted to stand for an hour or so, the supernatant clear fluid drawn off, and the dregs placed in a conical glass until the food substances settle. The sediment should then be drawn out by means of a long pipette, and examined in fresh and wet state with a low power.

The red meat fibers are seen in more or less separation of the fasciculi depending upon the motor status of the stomach and upon the

degree of acid-enzymotic secretion. They are seen as large-sized, reddish-colored columns displaying fine transverse striations. The starch is observed all the way from the characteristic kidney or oyster-shaped granule having a hilum and striations from it, to the loose amorphous matter which had been freed from the interior of the granule. The process of starch digestion may morphologically be described as: first, the granule, which, under absorption of water swells, loses its hilum shape and striations; then a rather stippled, round body with a two or three-armed dark remains of the hilum; then a globular sphere less distinctly stippled and with thinner membrane; and, finally, the bursting of the latter freeing the amorphous starch matter from the interior. The other vegetable substances are seen in a great variety of formations, both in the cellulose make up and also in the character of the contained cells. It is a fairly safe rule to follow, that any striking looking object seen, particularly when of large size and having well-marked stroma and cells, or any single cell of large or small size with confining membrane and large granule substance in its interior are very apt to be of vegetable nature. The green vegetables of course have the characteristic chlorophyll color, which such articles may retain even in the feces, and this readily distinguishes them. Fat is present in one or both of two forms. These are the highly refractive fat droplets which may be of any size, or the fatty acid crystals. The latter can readily be distinguished by their fine needle-like rosette formations, or thin arrangement in more or less regular bundles. Fatty acid crystals are usually yellow in color.

Fungi.—Of great significance in diagnosis is the occurrence of the various fungi in gastric contents. The commonest types of these is the yeast fungi and sarcinæ, which, under certain conditions, may be present in the stomach in enormous numbers. They usually occur together in states of gastric stagnation, and it is important to note that in gastric cancer the sarcinæ are generally absent (probably because of the absence of HCl) although the yeast bodies may be present in greatly increased amounts. The appearance of all of the fungi are readily recognized, without preparatory staining, by means of a moderately high amplification.

The appearance of yeast is very characteristic, presenting itself as small attached oval bodies, strung out in rows with occasional buds arranged at close angle to the parent body. Gram's iodine or Lugol's solution, or plain tincture of iodine stains them yellow. The sarcinæ are smaller rounded bodies usually found arranged in one of two formations. The first is the common cotton bale form arranged in squares or tetrahedra, sometimes colorless and glistening, at other

times a brownish-yellow. The second are the smaller sized, detached bodies arranged more in groups like micrococci. When doubt exists as to their presence, the cellulose staining method suggested by Boas would serve to distinguish them. This is simply performed by placing several drops of gastric contents (unfiltered) on a slide to which add about the same quantity of the following:—

℞	Zinci chloridum	20.0
	Potassium iodidi	6.5
	Iodidi	1.3
	Aquæ	10.5

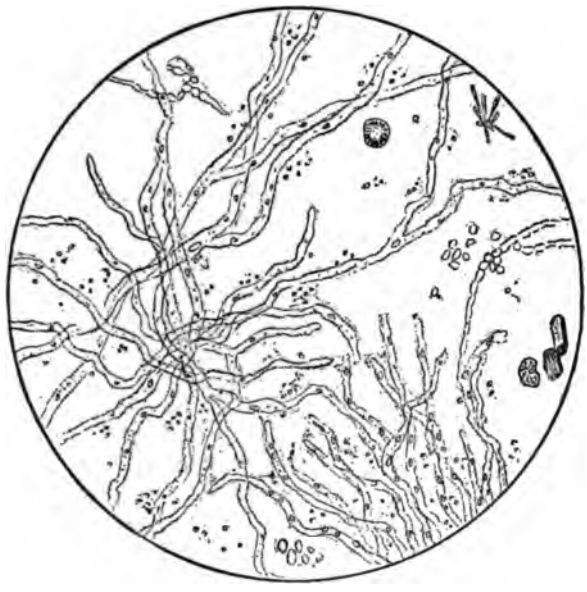


Fig. 40.—A greenish fungi found in the wash water of a stomach. Mycelia, free spores, and a few crystals. × 240. (After *Einhorn.*)

With a glass rod, or the rear end of a match, a thorough mixture is made, and the slide permitted to stand for several moments. Another very thin glass slide or a large cover glass is placed upon the specimen and examined with a rather high power, when it will be noted that the starches are stained a blue and the sarcinæ a violet-red. Under normal conditions but few sarcinæ can be found; in large numbers they are seen in the primary gastric atonies where the hydrochloric acid secretion is present in normal amounts or increased.

Einhorn has observed several other forms of fungi, among which he mentions a very small pellicle occurring in sparsely isolated groups,

a large greenish pellicle, and a blackish pellicle occurring in long, thread-like form. These with the yeast and sarcinæ are vegetable substances which have been introduced from without, and when fertilizing in the stomach may cause gastric symptoms until they have been removed by lavage.

Blood.—The microscopic examinations of vomitus and gastric contents in which large amounts of altered blood may be present

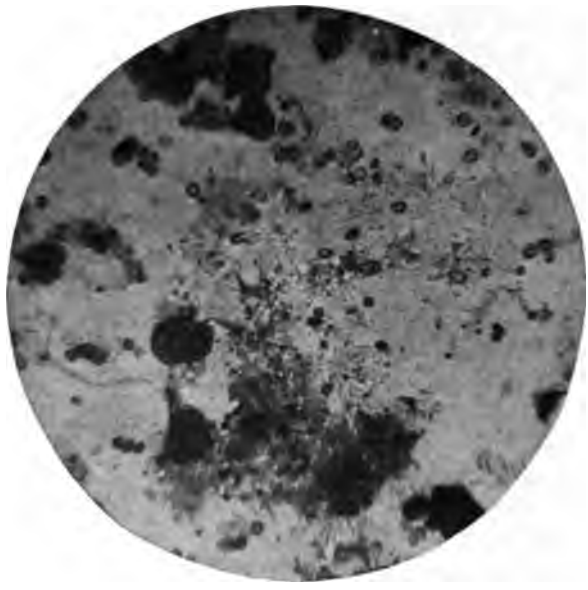


Fig. 41.—Photomicrograph of a portion of an Ewald test-meal aspirated from the stomach of a patient who had an acute gastric ulcer. The large dark objects are starch granules in various stages of digestion. Directly above the center is seen the typical oyster shell granule of raw starch with its hilum. Below the center, and elsewhere, are seen granules which had changed down to the free starch substance. Throughout the picture are seen red blood-cells. Stained with Gram's solution and eosine. × 600.

usually display more or less red cells which have not lost their morphological character. Such contents are often obtained from cases of carcinoma particularly when the growth is of the soft variety, or late in the scirrhous or colloid forms. In my opinion, such findings of hemorrhage constantly present in the aspirated contents of morning stomachs (when the traumatic form from the tube, or the swallowed forms can be excluded) are of much significance in making early diagnoses of stomach cancer.

Cases of acute gastric ulcer may be encountered in which, because of the absence of the characteristic subjective and objective symptoms, the presence of an ulcer would not at first hand be suspected, and not until a test-meal had been examined and the blood-cells noted. When in such instances a return through the tube comes up colored by admixture with blood it is a wise precaution to immediately withdraw the tube, and satisfy oneself with the examination of such return as may have been obtained.

The red blood-cells can usually be recognized in the examination of a loop or two of the unfiltered gastric contents. For the purpose of more definitely recognizing them, however, a specimen may be dried and fixed by heat and stained with an alcoholic or aqueous eosin solution of ½ or 1 per cent. in strength.

Pus.—Since in the mass of food in test-meals pus cells cannot definitely be distinguished by the microscope, and when obtained by lavaging the stomach, such great quantities of fluid are employed in which the cells must be sought, the dry aspiration or same after a small saline instillation are the better ways to make these examinations. Excepting pus cells which may be swallowed from ulcerative or septic conditions about the mouth, etc., pus cells regularly observed in contents from the fasting stomach are indicative of ulcerative conditions, and since ulceration commonly exists upon malignant processes—even when small in size—the finding of these cells are even more significant than increased bacterial flora. Also, the observation of large numbers of pus cells in aspiration of the empty stomach or in the vomitus constitutes the most valuable single symptom we have in diagnosing phlegmonous gastritis.

If a drop or two of aspirated contents, or the centrifuged sediment of the lower zones of the saline instillation, be placed upon a slide with a drop of acetic acid and a cover glass placed upon it, the pus cells can readily be observed in the specimen by using the high power lenses. They are usually seen as more or less irregularly-shaped globular bodies, about twice the size of the red blood-cell, in which one or more nuclei may or may not be seen. The apparent presence or absence of nuclei depends upon the amount of granulation; in coarsely granular corpuscles they are invisible, but are usually well-marked when the granulation is fine. Occasionally fat-globules and granules appear in the cells. With the pus cells are generally observed more or less distinct leucocytes with their sharply defined nuclei and clear protoplasmic substance. In observing the various types of cells from leucocytes to mature pus cells, it is desirable to stain one of the specimens by means of one of the basic dyes (after first drying and fixing

by heat). If too long a time has not elapsed for these elements to change in form from the water they have been in contact with, there will be noted the following types of cells—leucocytes (usually somewhat irregular in outline); cells with fragmentation of the nucleus associated with pyknosis; a fragmentation of the entire cell with the formations of mononuclear neutrophiles; and finally a large type of cell in which only a very irregular outline may be present. Generally when pus is observed the micro-organisms are a prominent feature in the specimen.

Crystals.—In vomited matter and aspiration of morning stomach contents containing bile, crystals of leucin, tyrosin, and cholesterin are quite commonly observed. These can usually be recognized by the form of their crystals, as well as by their chemical reactions. Both leucin and tyrosin resemble much the fatty acid crystals. The leucin occurs in the form of spherules of variable size, and resemble globules of fat, but differ from fat in that they are not dissolved by ether; the tyrosin (only rarely found) crystallizes in the form of very fine needles in sheave-like formations which are insoluble in acetic acid, but soluble in ammonia and hydrochloric acid; and the cholesterin in colorless, transparent plates, the margins and angles of which present a ragged appearance, and which are insoluble in water, dilute acids, and alkalies, but readily so in ether, chloroform, or benzol, and when touched with a drop of concentrated hydrochloric they gradually disappear, the edges assuming a yellowish-red color. Still more rarely found than tyrosin, are the oxalate crystals; these are readily recognized by their well-known square envelope shape, their insolubility in ammonia or alcohol, and their ready solubility in the mineral acids. Crystals of ammonio-magnesium phosphate (coffin lid), or magnesium phosphate may be encountered in alkaline contents.

Protozoa have been found in stomach contents by several observers. Among the varieties reported are the trichomonads, megastoma entericum, flagellates, amebas, and monads, two or more of which types may occur together in high degrees of stagnant conditions of the stomach, usually of the non-obstructive type. They are to be seen only in neutral or alkaline contents, and are best sought for in aspirated contents of the empty morning stomach, which must be examined when still warm.

Micro-organisms.—Other than the fungi above mentioned, stomach contents contain a number of bacteria, particularly in pathological conditions of the organ. The most important of the various types seen is a lactic acid producing bacilli generally known as the Boas-Oppler and also designated Fadenbazillen, long bacilli, or lactic

acid bacilli. These organisms occur in a number of morphological varieties, the most common of which is an exceptionally long organism, joined end to end, and arranged in long threads or zigzag lines (geniculate organism). The second common type, in my experience, is a shorter and thicker (but still large-sized) organism, which is usually encountered not as numerously in specimens as the first form.

The Boas-Oppler bacillus is probably of the genus leptothrix and is usually met with in large numbers in stomach contents of gastric

Fig. 42.—Photomicrograph of a portion of stomach contents from a case of gastric carcinoma displaying the Boas-Oppler bacilli. The stellate formations seen are a crystallization of the specimen produced in the drying, and these are sometimes mistaken for fatty acid crystals. × 200. Stained with 1 per cent. aqueous eosine and counterstained with methylene-blue.

cancer when the motility and chemism (HCl) of the organ is markedly interfered with. On these occasions they may also be found in the mouth, esophagus, or occasionally in the intestines, to which localities they are probably carried from the stomach in the vomitus, or by exit through the pylorus. Contrary to other saprophytes (yeast, sarcinæ) which can proliferate in delayed conditions of the stomach, the long bacilli require marked stagnation of the organ, and, since the dual agencies of absence of digestive stomach secretion and high degrees of obstruction are more commonly present in gastric cancer they are of much significance in the diagnosis of that disease.

When these organisms are found, lactic acid is invariably present in large amounts; proving that they are active lactic acid producers. In this connection it must be remembered, that in benign pyloric stenosis, and sometimes in high degrees of primary atony, lactic acid may be present in plainly increased amounts, but I have yet to see the stomach contents from a non-malignant case show definitely the presence of the long bacillus, and for this reason I believe them to be of much significance in the differential diagnosis between malignant and non-malignant conditions of the organ. The matter is simply one

Fig. 43.—Photomicrograph of a portion of stomach contents from a case of gastric carcinoma showing Boas-Oppler bacilli, short bacilli, strepto- and staphylo-cocci. × 1000. Stained with methylene-blue.

of the degree of stenosis—which is the most marked in cancer—and that of the HCl secretion which is more characteristically absent in malignant disease. The demonstration of the long bacilli is even a more important diagnostic finding than lactic acid, since only a small amount of gastric contents are necessary for examination, and no precautions as in the amount of lactic acid found in the contents need be taken.

The bacillus is non-motile, is readily dyed by any of the aniline stains, but not so by the iodine solutions. The commonly seen type can easily be recognized by the medium or high amplifications—without preparatory staining—as a long glistening rod, uniform in diam-

eter, irregular in arrangement, and these with their countless numbers (usually like so many straight sticks) serve to distinguish them. In the staining methods, a drop or two of unfiltered stomach contents is spread out upon a slide, the specimen dried and fixed by heat, and aniline, gentian-violet, methylene-blue, eosin, or other solutions used. For these, as well as for all other examinations for bacteria or fungi, the unfiltered contents should always be employed.

Among the other types of organisms present in stomach contents should be mentioned the pyogenic forms (staphylococci, streptococci)

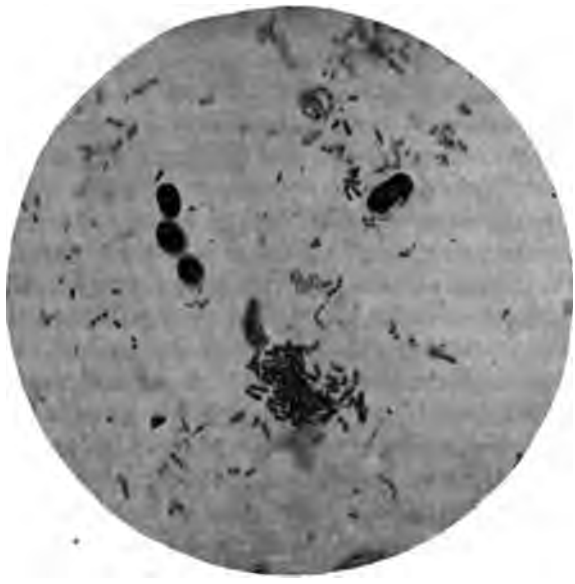


Fig. 43*.—Photomicrograph of a portion of stomach contents from a case of gastric carcinoma showing a clump of streptobacilli. × 1000. Stained with methylene-blue.

occurring in ulceration and septic conditions of the organ. In cancer situated at the fundus, in the body of the stomach or at the cardia, the presence of these micrococci in the aspirations of the empty stomach may be of much value in diagnosis. Such organisms may also be present in contents from phlegmonous gastritis (usually streptococci) and chronic ulcer (usually staphylococci). In these examinations the swallowed variety from the mouth, throat, or respiratory tract must be excluded. This can only be accomplished in a relative way, since normally the mouth contains a variety of bacteria which are swallowed in the mouth secretions. The results of the examinations for them are not of significance unless the extraneously-introduced micrococci

can be excluded to a definite extent, and only when a certain type of organism is always predominant in a suspicious way in large numbers and in a number of extractions at different times. In cancer of the stomach situated extra-pyloric, I have noted in several cases the presence of a streptobacillus in large numbers. In tubercular ulceration of the stomach (which is an exceedingly rare disease), but commonly in pulmonary tuberculosis when the sputum contains large amounts of tubercle bacilli (which are swallowed), aspirations from the morning stomach often contain tubercle bacilli. These organisms are stained for in the usual ways; the pyogenic by means of methylene-blue, gentian-violet, etc.; and tubercle bacilli by carbol-fuchsin, decolorized with 5 per cent. sulphuric acid, and counterstained with methylene-blue, or the Gabbet, or Ziehl-Neelsen's methods.

Tissue Particles.—Of great diagnostic importance is the examination of shreds of mucous membrane or tumor particles that may be found in stomach contents. It not infrequently happens in sarcoma and cancer that small tissue particles are accidentally encountered in lavage water, and the same may be said of chronic gastritis and cases of increased secretion of gastric juice. When these are very small in size or incorporated in blood clots, but poor results in the way of convincing deduction are derived from the microscopical examination of them, but when of some size, they can be plainly recognized by the naked eye and are usually large enough for hardening and section, and thus a detailed examination of the most satisfactory kind can be made.

Exfoliation of the upper regions of the glandulature of the stomach is particularly apt to occur in chronic gastritis (catarrhal ulcers). In my experience such detached particles are very small in size, colorless, and liable to escape detection; on the other hand, quite good-sized delicately soft, pinkish colored particles may be encountered in states of high secretion—these appear, when suspended in a saline solution, like rather compact villous decidua from a pregnant uterus. In the examination of detached tissue particles from cases of chronic gastritis it is possible to note the degree of degeneration, loss and proliferation of the cellular elements, and the interstitial infiltration and extent of hyperplasia between the tubules themselves. All these are valuable diagnostic, therapeutic, as well as prognostic helps in each of the cases.

In malignant disease of the stomach (cancer and sarcoma), it is surprising that, judging from the frequency of the hematemesis and the ulceration within the stomach, one so infrequently meets with particles of detached tumor tissue. This is probably because of the greater frequency of cancers of the scirrhous variety, the relatively

smaller size of the softer forms within the organ, and the fact that many of the slower growing types following ulcer are mostly extraglandularis in location. It is quite probable that in many of these, as well as in sarcoma, only very small particles of the growth are shed, and that these are so minute in size and modified by ulceration that they escape detection in the first instance. For these reasons I have concerned myself for years with the careful examination of centrifuged sediments of instillations from cases a few of which, at autopsy, proved the correctness of the diagnosis of malignant disease. On a few occasions in these I had obtained tumor particles large enough to section and upon which definite diagnosis by the microscope could be made, but in the majority of instances these were not obtainable. In a number of them I observed numerous, free, small round cells which probably were from the malignant growth, but I never was able to satisfy myself that those I saw were always from the growth itself and not free nuclei from innocent cellular elements or very small cells from the vegetable substances of foods. When one has a case in which clinically a diagnosis of gastric cancer is most probable, the examination of the cellular elements from the stomach often gives encouraging results in the way of noting cancer cells. But in these instances the mind is already biased in favor of the findings, and an unwarrantable extent of diagnostic deduction from what is seen takes place. It is quite a different matter to see the same microscopical picture from a stomach where doubt of malignancy exists, or from a case that has not been seen by the one who makes the microscopical examination, and say, "That cell is from a cancer; that is vegetable substance; those are free nuclei from squamous cells, leucocytes, pus cells, etc." I doubt that cancer cells can be definitely distinguished as such, unless some tissue stroma is with them so as to make up the pathological picture of malignant tissue.

References.

[1] Mathieu et Remond: Soc. de biolog., Nov. 8, 1890.

[2] Boas: "Diseases of the Stomach," p. 157.

[3] Krukenburg: Inaug.-Diss., Heidelberg, 1888.

[4] Martius and Luttke: Die Margensäure des Menschen, Stuttgart, 1892.

[5] Leo: Centralbl. f. d. Medizin. Wiss., 1889, vol. xxvii.

[6] Hayem et Winter: "Du Chimisme Stomachal," Paris, 1891, p. 72.

[7] Kossler: Zeitschrift für physiol. Chemie, 1893, Bd. 17, S. 91.

[8] Raue: Made by the Valzahn Co., Philadelphia, Pa.

[9] Strauss: "Ueber eine Modifikation d. Uffelmann'schen Reaktion," Berliner klinische Wochenschrift., 1893, Nu. 37.

[10] Kelling: Zeitschrift für physiol. Chemie, 1893, Bd. 18.

[11] SIMON: "Clinical Diagnosis," sixth edition, p. 235.
[12] BOAS: "Diseases of the Stomach," p. 194.
[13] O. AND R. ADLER: Zeitschrift für physiol. Chemie, Bd. 41, Heft 1 and 2, p. 59.
[14] EINHORN: "A New Blood Test," Medical Record, June 8, 1907.
[15] HOPPE-SEYLER: Deutsches Archiv für klinische Medizin., 1892, Bd. 50, p. 82.
[16] LORENZ: Zeitschrift für klinische Medizin., 1891, vol. xix, p. 19.
[17] SOLMS: Zeitschrift f. klinische Medizin., Bd. 64, Heft 1 and 2.
[18] EINHORN: Medical Record, August 29, 1908.
[19] BOLDYREFF: Pflüger's Archiv, Band 121, Heft 1 and 2.

CHAPTER VIII.

Significance and Methods of Examination of Feces in Gastric Diseases.

As our knowledge of digestive diseases advances the examination of feces occupies a constantly enlarging significant rôle in diagnosis. Considering that the stomach is only one section of the digestive tract, and that a digestive disorder in this organ may be compensated for in the intestines, in so far as the direct diagnoses of most gastric diseases are concerned, the examination of the feces possesses only a minor primary value—this excepts the tests for blood due to gastric hemorrhage. But in the diagnosis of intestinal conditions, either primary or as such may occur secondarily from digestive error in the stomach and upper part of the small intestine and cause symptoms referred to the stomach, the feces examinations are of much importance. Of late, a more or less rightful tendency has developed in the consideration of digestive disorders in the way of attaching a minor importance to detailed examinations, and diagnosing digestive errors by the ingestion of certain foods in known quantities and the examination of the feces to note the general status of its digestion and resorption in the gastro-enteric canal as a whole. While such is of vast service in the regulation of diets—in even what may be considered as only gastric cases—and in the diagnosis of gastro-enteric atrophy and distinct bowel conditions, it has its limitations in noting the locality of disease, and also the diagnosing of the various conditions found present only in the stomach or the small or large intestine. Personally, I believe that the long established older custom of gastric analysis and feces examinations should be retained, to which as a third means of diagnostic and therapeutic procedure what may be termed as the food-feces method should be added. Since the analysis of a stomach content expresses more definitely the digestive condition or presence of disease in the alimentary canal at and above the pylorus, the examination of feces embraces the dual diagnostic and therapeutic importance of both the stomach and intestines, and for this reason the examination of the feces will be offered in some detail.

The feces is made up of a mixture of indigestible and undigested particles of food, the unabsorbed secretions of the gastro-intestinal tract, and their decomposition products together with intestinal mucus, bacteria, etc., which are mostly added to it below the pylorus. In addition to the examinations of these is the information that is obtained by naked-eye inspection of the stools relating to their odor, reaction, shape, consistence, color, and observance of particles of food.

The number of stools which a person passes in twenty-four hours under like and normal conditions are more or less constant. In the infant about four, in the child about two, and in the adult one passage a day may be taken as desirable standards, although in adults two passages a day, or the bowels moving only every second day are not extreme unphysiological departures. Adults whose bowels move less frequently than once every two days, or only when energized by laxative or purgative agencies, may be considered as constipated. Among the gastro-intestinal conditions in which constipation is particularly noted are: alterations in the quantity or quality of the digestive fluids; a deficiency of bile secretion (although when stenotic conditions of the bile passages are present for some days the resulting increased putrefaction and irritation of foods in the intestines may cause a looseness of the bowels); in esophageal and pyloric stenosis because of the small amounts of foods which pass into the intestines; in ptosis of the abdominal organs, and myasthenic or atonic conditions of the gastro-enteron or abdominal walls; in deficiency of the motor power of the intestines, either because of local atonic or atrophic disease, or secondary to low constitutional states; in hernia, contracted (spasmed), organic, or malignant strictures of the small and large intestine and rectum; in sigmoid paresis from local causes or reflexly from disturbances of the internal generative organs in the female; and for dietetic reasons, such as deficient ingestion of water, too little vegetable substances, or a high albumin or milk diet.

In diarrhea, the consistency of the stool is materially diminished, and the number of daily movements are increased. Among the gastro-intestinal conditions in which the latter are noted are the following: an acute gastritis and enterocolitis, and in the acute exacerbation of the low secretory and myasthenic chronic forms (where because of fermentation of foods in the stomach, or acute extension of the catarrhal process into the duodenum, the foods act as intestinal irritants); in the infective diseases of the intestines (acute enteritis, Asiatic cholera, cholera infantum, typhoid, etc.); in ulcerative or malignant disease of the lower bowel or rectum; and in the acute poisonings (arsenical, non-edible mushrooms, etc.).

The amount of feces voided in twenty-four hours is of some significance in the diagnosing of digestive disorders. Leaving out of consideration the small fecal output in stenotic conditions of the alimentary canal, the dry, condensed, scybalous movements in habitual constipation, and those conditions where from excessive admixture with water the weight of the excreta is increased, the excretion of unusually large amounts of feces may be observed in constipation: when from collection much feces is voided during a short time after the release of an obstruction, particularly in the lower colon or rectum; in biliary obstruction, where from lack of sufficient digestive flow of bile much food fails of absorption because of complete digestion; in enteritis, where because of lack of the proper digestive secretory and motor functions low food conversion is met with; and lastly, in fermentative or putrefactive irritative conditions of the gastro-intestinal canal (the colon particularly), where inhibition of resorption or perversion of proper food conversion exists. The extreme limits in health may be regarded as 60 to 270 grammes, the quantity being low in proteid diets, and high in heavy eaters and in high indulgence in vegetable or starchy foods. Over 500 grammes are usually pathological. Schmidt reported a case of enteritis in which the output in three days was 2780 grammes, and even larger figures have been reported—mainly in constipation. My experience has been that in a normal adult of average build whose bowels move daily, the normal output should be about one gramme of feces to each pound of body weight. This, of course, is subject to variation according to the amount and character of foods taken, and the amount of adipose tissue in the body make-up of the individual.

As was stated before, the consistency of a stool depends upon the amount of water present, and this is high in purely vegetable diets (80 per cent.), and low with proteid foods (60 per cent.). A stool formed from a mixed diet is about 75 per cent. water. In appearance, a normal stool may be considered as the first part cylindrical-shaped, and the last part a rather firm mush. A stool made up of many small-sized, marble-shaped masses (scybala) is commonly observed in constipation from any cause. Ribbon-shaped or pencil-sized stools are seen in enterospasm from neurotic, irritative spasmed from digestive causes, or organic strictured states of the colon.

The odor and reaction of stools are of some value in the diagnostic way. The odor of a normal stool is not particularly unpleasant, or it may have but a very slight odor. When to the normally present aromatic substances (indol and skatol) much sulphurated hydrogen, methane and phosphine are added, a disagreeable odor is met with—

such stools are seen in jaundiced or other conditions in which there is a deficiency of bile in the intestine (acholic stools), in acute gastritis or enteritis and both together, and occasionally in constipation, etc. An unusually offensive stool is met with in ulceration (syphilitic), malignant (cancer), or infectious (gangrenous dysentery), and in disease of the lower bowel or rectum. An ammoniacal odor is due to an admixture of urine which is undergoing decomposition.

The most common reaction of normal feces is alkaline, sometimes it is neutral, but rarely acid. The alkalinity is probably due to ammonical putrefaction, and when an acidity exists it is usually due to lactic and butyric acid production from excessive fermentative or putrefactive changes in the lower bowel. At times, particularly in diarrhea, the feces may be strongly alkaline, a condition also rather commonly present in fermentative conditions. As there is still much doubt about the reaction of the feces as pertaining to the organisms concerned, too much clinical significance cannot be attached to these examinations. The practical deductions to-day may be considered in the recollection that digestion in small intestine is alkaline, and that when acidity of stools exists such must have been caused by organisms in the lower bowel, and that should the food contents have been hurried through, a distinct alkaline may be present. Still, a higher acidity than what may be considered as normal cannot be looked upon as positive evidence of putrefactive conditions, since the alkaline producing micro-organisms may be concerned in modifying or changing it to an alkalinity.

The color of stools has some diagnostic importance. Ordinarily the color is modified by the character of foods that had been ingested. In exclusive milk diets the stools are a light yellow; the starches may also lighten the color. Red fruits may give them a reddish tinge, and vegetables with much chlorophyll may produce a greenish hue. Huckleberries and red wine produce a blackish color; chocolate and cocoa, a gray; and preparations of iron, manganese, bismuth, and cerium, a dark brown, black, or greenish gray. Calomel usually produces stools colored green with biliverdin; santonin, rhubarb and senna, a yellow color; and ipecacuanha a very light color, almost an acholic stool. Hard stools are usually dark in color, pasty stools a brown, and diarrheal movements considerably lighter. The surface of feces exposed to the air darkens from oxidation.

In the pathological conditions in which change in the color of the stools are observed are, firstly, the clay-colored stool which is characteristic of deficient amount of bile coloring matter in the intestine for stenotic reasons in or about the gall-bladder or ducts, or deficiency

of hepatic function in the manufacturing of bile. Such stools are usually soft and pasty, and sometimes even a white in color. Strümpell has advanced that such stools are not so much due to deficiency of bile coloring matter, as they are to the insufficient absorption of fats which occurs in these conditions. The factors in favor of this contention is that such acholic stools may occur in leukemia, chronic nephritis, chlorosis, tuberculosis of the intestine and peritoneum, etc., and still the gall passages be patent. On the other hand, are the facts that in these conditions bile may not be excreted into the intestine in the normal way, the fact that bilirubin may undergo decomposition into colorless products (leuco-urobilin of Nencki), the fact that all such acholic stools are not high or increased in amounts of fats, and the close association of pathological findings about the biliary area in most of the cases in which acholic stools were steadily present. An admixture of large amounts of pus may also cause a light-colored stool (dysentery, perforation of pelvic abscess into the rectum, syphilitic and carcinomatous ulceration of the colon and rectum).

A second type of stool is the one produced by admixture with blood, which may present a scarlet-red, a dirty brownish-red, a coffee-ground, or a black, depending upon the source of the hemorrhage, the length of stay in the bowel, the amount of blood and the condition of mixture. Blood from low in the colon or rectum is observed bright in color and usually found on the surface of the feces (adherent blood) and not in the interior of the stool when this is of some firmness. Such is commonly observed in hemorrhoids, malignant, ulcered and inflammatory diseases of the colon and rectum.

An intimate admixture with blood is the type of stool that most concerns us in the diagnosis of gastric conditions. In these instances the blood is so altered by the digestive fluids in the stomach and small intestine that it assumes a black or brownish-black appearance or may resemble coffee grounds (dark color is due to the formation of ferrous sulphide). On the other hand irritative conditions of the stomach and small intestine with bleeding may exist in which the contents are passed along so rapidly that the blood presents itself in the stool quite bright. However, when the stools are of some consistency and the hemorrhage of large extent, such blood will be found to be intimately incorporated with the feces as well as free on the surface. The important point to remember is as to whether the blood is found only on the surface or outer layer of the feces as is seen in colon and rectum bleeding, or if it is only or also intimately incorporated with it as is observed when the bleeding comes from a higher source (such as ulcer or malignant disease of the stomach and small intestine, ruptured esophageal

or gastric varix, and the swallowed variety from the nose or lungs). Such stools are usually quite readily recognized with the naked eye, or by the examination of a loop or two from the interior of the feces by the microscope. Often conditions in which blood may macroscopically be observed are strangulated hernia, intussusception, severe gastritis and enteritis, amyloid disease of the intestine; corrosive poisons, especially arsenic and phosphorus, rupture of an aneurism of the abdominal aorta into the digestive canal; aneurism or thrombosis of the superior mesenteric artery, from congestive stasis and hemorrhage produced by obstruction of the portal circulation (cancer or cirrhosis of the liver, valvular disease of the heart, portal thrombosis, pulmonary emphysema); in the infectious diseases (yellow fever, pernicious malaria, acute yellow atrophy of the liver, typhoid, septicemia, pyemia); in the blood disorders (leukemia, hemophilia, purpura hemorrhagica, scurvy); in injuries to the bowel, and in intestinal parasites.

Of interest particularly is the presence of blood as a diagnostic measure in ulcer or cancer of the stomach and small intestine, hemorrhagic pancreatitis, and catarrhal jaundice. In these the blood may be so small in amount, or it is so changed in character that its presence may not be noted with the naked eye (occult blood). Such stools are of great diagnostic significance in digestive disorders, and would be overlooked unless chemical tests for the presence of blood be performed. In fact, I may say, that in gastric and duodenal ulcers, in all of the acute, partially healed, or chronic forms, and in malignant disease (both primary cancer and sarcoma of the stomach) this objective symptom ranks of the first importance in the diagnosis. It is surprising how constantly blood is found present in the feces in most of the cases in the above mentioned conditions. This, however, excepts many of the cases of extra gastric cancer (ulcus carcinomatosum), and some of the cases of scirrhous gastric carcinomata where these are very hard and non-ulcerated. When performed under proper conditions, a positive blood-reaction of feces—even when slight—should never be looked lightly upon or discarded without an exhaustive examination. Particularly is this true when such findings are rather constantly present. As time goes on I am attaching more and more importance to the value of these tests in the early diagnosis of malignant gastric disease, since such are often observed long before tumors are palpable, and characteristic chemical and dynamic changes, or the common objective or subjective symptoms develop. In ulcers the blood is usually intermittently present, that is all the way from coffee-ground stools from large amounts of blood, to stools in which blood is not recognized (excepting by the chemical tests), and stools which at

one time are blood-free, and at another time it is present. In cancer the chemical tests are more regularly positive, although macroscopically blood is rarely observed—sometimes not even to the fatal issue of the case. This also holds true in sarcoma in which the loss of the gastric secretions and motor function of the stomach, palpable tumor, and other symptoms of note in malignant disease may be absent altogether; in which case the gastric functions of the stomach are too slightly modified for definite diagnostic purposes. Excepting in some cases of cancer of the gall-bladder and the other conditions of the biliary passages in which blood-stools may be observed, it usually manifests its presence for only a short time. Other sources of bleeding must, of course, be excluded, and that from meats and fish in the diet must also be excluded—this cannot be done unless these articles of food have not been taken for at least forty-eight hours before the passage of the examined stool, assuming that the bowels are moving freely.

The technique of examination is about as follows: For adherent blood a loop or two of feces is scraped from the surface and mixed with a drop of water on a slide. This may be dried, fixed and stained in the usual way for blood, or a cover glass is put upon the wet specimen and examined directly for the presence of red blood-cells or masses of hematoidin which appears as brownish-red masses. The incorporated blood is examined for in the same way as a portion of the interior is taken. As a rule unless the bleeding had been great in extent and the blood fresh (when it would be noticed macroscopically by its color), these examinations are not satisfactory and must be followed by the chemical tests described in the foregoing chapter (page 182). Of these in my experience the tests arranged in the order of their practical value for feces are the aloin, guaiac, benzidin, and hemin. For the color tests about 5 grammes of the softest portion of the feces are mixed in from 5 to 10 cubic centimeters of water, and separated with glacial acetic acid and ether in the usual way as for gastric contents.

Among other findings which have a practical value in diagnosing conditions of the digestive canal, particularly the intestines, and which may be observed macroscopically, are mucus in catarrhal conditions of the colon and rectum (colitis, proctitis, coloptosis, mucous colic, etc.); pus (rupture of an abscess in the intestinal canal, dysentery, proctitis, ulcerative conditions or malignant disease in the colon, sigmoid and rectum); fatty stools which may be recognized by their oily, greasy appearance (obstructive jaundice, overfeeding, disease of the pancreas or impacted pancreatic calculi); gall-stones picked from the stool or observed after a watery mixture had been made and strained

(cholelithiasis); foreign bodies, such as pins, coins, buttons, etc., that had been swallowed or introduced from without in children or hysterical persons; the intestinal parasites, ascaris lumbricoides, oxyuris vermicularis, or segments of tenia; and pieces of organic tissue such as polypi from the rectum or colon, the invaginated segments of bowel in intussusception, and necrotic sloughs from tumors or inflammatory

Fig. 44.—Looking down into a twelve-inch bowl of water containing the mucus of one stool from an advanced case of membranous colitis.

processes. Casts of mucus from cases of prolapse accompanied with colitis may readily be observed as long white or yellowish stained rolls or lamina of firm fibrous-looking masses.

In the study of conditions in the digestive canal, the microscopical examination of feces may display most important clinical data. These observations are simply performed by making a watery mush of a small portion of the feces and of which one or two drops are taken, or

applying a loop of soft feces to a drop of water on a slide and examining it directly under a cover glass, first with a low power for amount of food remnants (muscle fibers, vegetable substances, fat, etc.), crystals, pus, blood, bits of tissue, mucus and eggs of parasites; then with the medium power, for verification, to make out details of structure, and the smaller animal parasites (trichomonads, amœba coli, etc.); and lastly the high power for the bacterial flora. In the latter, drying, fixing, and staining are essential. Unless living organisms are to be

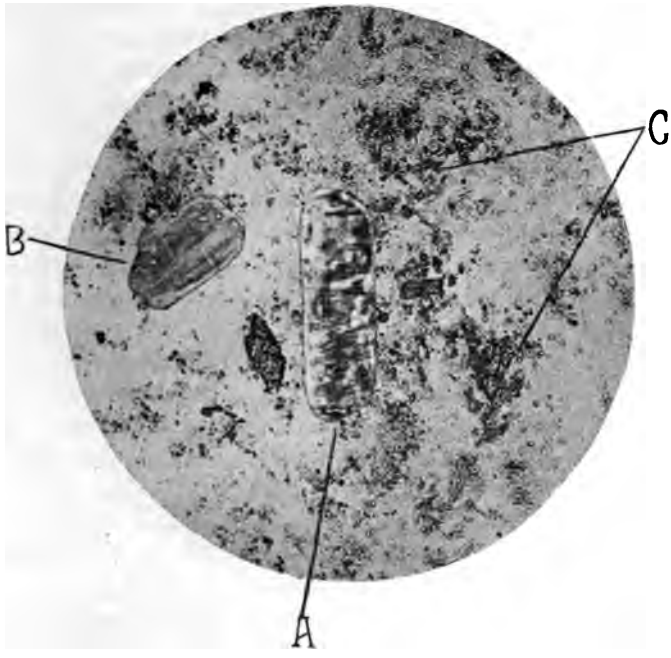


Fig. 45.—Photomicrograph of feces showing muscle fibers. *A*, Striated fiber, partially digested. *B*, Fiber showing no striæ, further stage of digestion. *C*, Amorphous food material. × 670.

searched for, the wet specimen on the slide may be covered with a layer of turpentine to diminsh the disagreeable odor (the use of a small portion of specimen covered by a cover glass usually suffices).

Meat fibers are usually observed in every stool whenever meat had been eaten. Under normal conditions they are not many (excepting in heavy meat eaters), but in atrophic conditions of the gastroenteron they may be very numerous. In these states a clinical importance can be attached to the number and character of the fibers seen (since their appearance is usually many twenty-four or thirty-six

hours after the mixed meal), and the more or less normal loss or separation of the transverse striations are not observed. In the process of normal digestion, the meat fibers are separated from one another, and then a separation of the disks at the transverse striations occur. In atrophic conditions when the digestive secretions are scant or absent, or when for irritative reasons the food is hurried through the canal, the fibers observed are all about the same size and shape (cylinders with parallel sides), with the characteristic cross lines between the unseparated disks sharply defined.

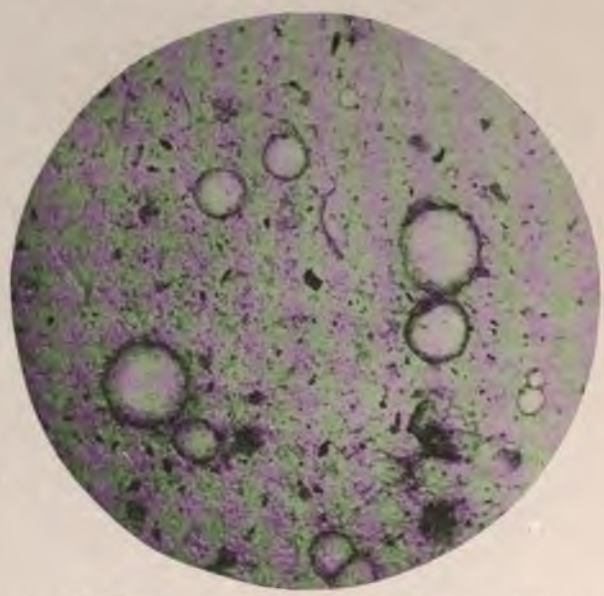


Fig. 46.—Photomicrograph of a drop of feces from a case of chronic enteritis (small intestine) showing the accompanying steatorrhea. The round, whitish, glistening masses represent the fat; the other particles, undigested foods and detritus of feces. × 320.

Isolated starch granules are not often observed in the feces of an adult, and are not of much clinical significance when they are. Their presence is easily recognized by treating the specimen with a drop of Lugol's solution when the granules or fragments assume a blue or a mahogany-red according to the stage of conversion. The indigestible cellulose framework or skins of vegetable substances are commonly observed but are of no practical significance.

The presence of fat in feces is quite constant in normal stools. The common form in which it is observed is that of the needle crystals of fatty acids (which are readily transformed into fat drops by the

addition of sulphuric acid and heat), although the highly refractive fat droplets may be observed in the first instance. In the acholic stools, from whatever cause, the fat proportion is immensely increased so that crystals and droplets will mostly comprise the field. This is an important fact, because a light stool may be observed when bile was being discharged into the intestine (leuco-urobilin formed), and thus an acholic stool should not be decreed unless the excess fat picture is microscopically observed. Another reason why the fat exam-

Fig. 47.—Photomicrograph of a drop of feces from a case of chronic catarrhal enteritis showing crystals of neutral calcium phosphate. × 70.

inations should be made is because extensive disease of the pancreas may exist without seriously affecting the amylolytic digestion.

Other crystals that are also commonly observed are the calcium and magnesium salts, and cholesterin. Of the first two, the kinds ordinarily seen are neutral calcium phosphate, calcium oxalate, calcium sulphate, and ammoniomagnesium phosphate. They possess no special significance unless present in large numbers.

The calcium and magnesium crystals are commonly increased in errors of digestion. In the chronic catarrhal conditions, particularly of the small intestine, they possess a diagnostic significance when markedly present. The neutral phosphates are not stained by bile

pigment, and the triple phosphate only in rare instances. Both are soluble in acetic acid. The calcium oxalate crystals are observed in high vegetable diets, and when a low state of conversion of carbohydrates is present in the digestive canal. These crystals are generally imbedded in vegetable substance, and are usually bile-stained, and are insoluble in acetic acid. Calcium lactate crystals are common in milk diets of both the infant and adult. They, with calcium sulphate, are of no significance. Cholesterin, while normally present in feces, is

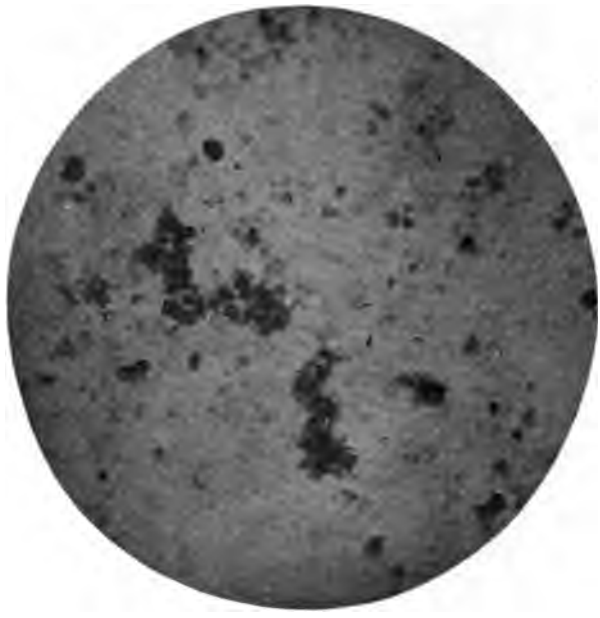


Fig. 48.—Photomicrograph of feces which had stood for two days showing mostly crystals of ammoniomagnesium phosphate. × 70.

rarely observed in crystal form. Hematoidin crystals may be seen where blood is present, and the Charcot-Leyden crystals may be found in typhoid, dysentery, and phthisis.

The significance and examination for blood, pus, tissue, and sloughs, have already been described. Particles of tissue are difficult to obtain from feces unless they are passed alone or in very fluid stools. When obtained they should be hardened, cut, stained, and examined in the usual way.

Small particles of mucus are observed only by the microscope. They are commonly met with in catarrhal, infectious, ulcerative, and malignant conditions of the digestive tract, and possess a diagnostic

significance. When small in particles, incorporated with the feces, and bile stained, they are indicative of disease of the small intestine. When from the region of the ileocecal valve the mucus is observed in larger particles and colorless or only partly bile stained. In colonic conditions (colitis, coloptosis, constipation), the mucus may be passed in long fibrous-looking masses, which, under the microscope, display characteristic mucous structure with more or less fecal detritus adhered to them. In the event that such patients are constipated as they usually

Fig. 49.—Photomicrograph of a portion of the same mucus as is shown in Fig. 44. Note that its structure is simply that of mucus and is not fibrous in nature as its appearance would suggest. The dark spots represent adherent particles of feces. × 70.

are, the mucus may be stained a yellow from length of stay in the colon, and is often passed in large quantities at the time of stool. At other times such mucus may not be noticed macroscopically unless the fresh stool is examined in water, when the ends of the shaggy mucous formation will be seen to be floating off from the feces (when the stool is soft this may not be observed). Mucus derived from the sigmoid and rectum is usually the clear viscid fluid variety, and more or less steady loss of this may occur at intervals between stools; some patients passing as much as 30 cubic centimeters or more of such mucus at one time. Fluid mucous stools are commonly observed in

sigmoiditis, proctitis, marked membranous colitis with catarrhal extension low in the large bowel and rectum, and in beginning ulcerative, infectious or malignant in these locations (in the latter more or less pus and blood are present in the mucus).

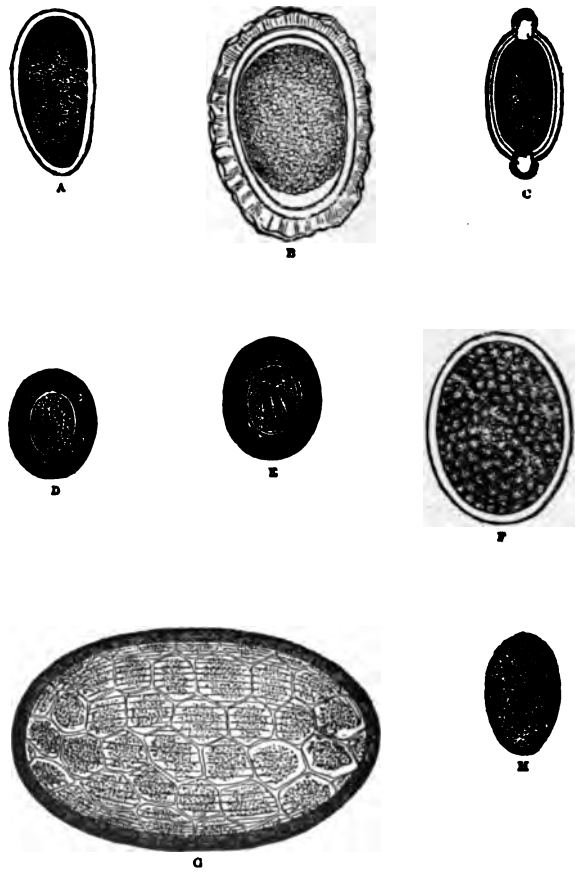


Fig. 50.—Ova of entozoa, × 350 (after Heller). *A*, Oxyuris vermicularis. *B*, Ascaris lumbricoides. *C*, Trichocephalus dispar. *D*, Tænia solium. *E*, Tænia saginata. *F*, Bothriocephalus latus. *G*, Distoma hepaticum. *H*, Distoma lanceolatum.

In the animal parasites and segments or ova from them that may be encountered in feces are those of the protozoa and vermes. Of the first, the important one is the amœba coli, which, when examined in fresh wet warm specimens with a medium power, is noted as an actively-moving, roundish, cell-like body. In a specimen of feces I recently examined from a fatal case of amebic colitis without liver

abscess, in a woman who was born in and had never left a seaside town in northern New Jersey, I noted at least fifty active ameba in one field.

If the adult worms (vermes) are not recognized in the feces, the ova from them may be examined for. In the above illustration the ova of the common forms are shown with sufficient distinctness for the purpose of identification. Matter pertaining to the less common forms of animal parasites, such as those reported from the East, Greenland, etc., can be found in works on animal parasitology.

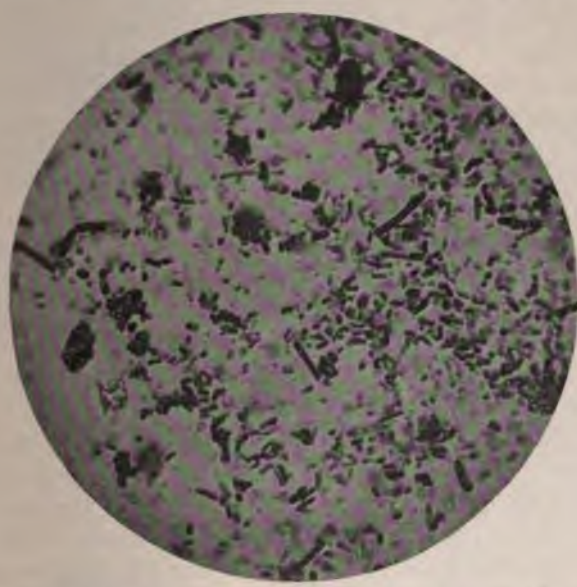


Fig. 51.—Photomicrograph of a field of fecal bacteria showing their great numbers and variety. The dark clumps are indigestible vegetable substance. In this specimen the anaërobic bacteria were found in increased numbers. × 1000.

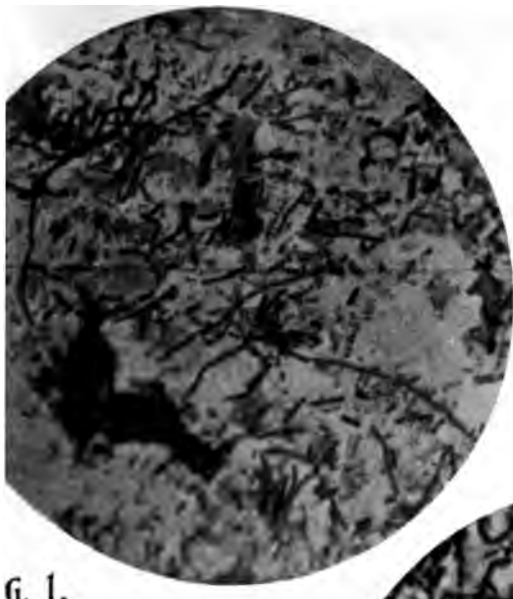
As I had drawn attention to several years ago, the Boas-Oppler bacilli from the stagnant stomach of pyloric carcinoma may be found in the feces and often in great numbers. The fecal bacteria in normal stools are noted in a variety of forms and sizes. Some of these, among which are the fungi, are large in size and may be mistaken for the Boas-Oppler. In distinguishing the latter from the long, thick-rodded, less important forms, it is essential to keep in mind that the Boas-Oppler are larger in size than any bacteria commonly seen, and in pyloric cancer they may be the predominant organism, in which case, they are always easily observed. In an individual who gives a suggestive his-

tory and the clinical symptoms of cancer are present, and in whom a mass may be felt in the epigastrium, the finding of large amounts of Boas-Oppler bacilli in the stool together with the presence of macroscopic or occult blood, the diagnosis of cancer can be made in almost every case. In consultation work when my suspicions were strong that advanced malignant disease of the stomach existed and the patient had not been prepared for the extraction of a test-meal at the time, it has been my custom to make a slide of the secretions on the back of the tongue and to order the sending of a specimen of stool. When cancer with pyloric obstruction exists, the mouth slide often shows the presence of Boas-Oppler bacilli in the mouth, carried there, no doubt, by the vomitings or regurgitations from the stomach (these must be distinguished from the leptothrix buccalis, which are also long bodies, a matter that is easy by the morphological difference between the two and the fact that the leptothrix stains readily with iodine while the Boas-Oppler do not). The stools, however, usually show the more positive findings, for in the feces the leptothrix is rarely or never found and the Boas-Oppler quite common. In such instances, the examination of the gastric contents for diagnosis is unnecessary.

Without considering the specific organisms found in certain infectious diseases (Bacillus dysenteriæ Shiga, Bacillus typhosus Eberth, B. tuberculosis Koch), other organisms are found in large numbers in the feces. Their numbers have been estimated at one hundred and twenty-six billions for the daily human excreta, but of these probably not more than from 1 to 5 per cent. are living organisms. This death of bacteria occurs in the lowest portion of the gut, the living organisms being in largest proportion in the vicinity of the ileum and ileocecal valve. Most of the forms, if not all, had originally been introduced from without in food and drink, and their vast numbers show that they readily proliferate in the digestive canal particularly when the conditions for their doing so are favorable. The most prominent of such conditions are a shortage in the defensive action of the digestive juices (achylic conditions of the stomach, etc.) or a diminution in the antagonism between them (such as a low proportion of the bactericidal coli group); it is probable that the latter is due to the reaction of the fluids of the digestive canal since an alkaline media is favorable to the putrefactive functions of this group if peptones be present—thus the importance of the reaction of feces in the clinical way.

To no one as much as to C. Herter is due the credit of the study of the bacterial flora in the digestive tract.[1] While this author in his extensive work drew but few practical deductions from his observa-

PLATE XXIV.



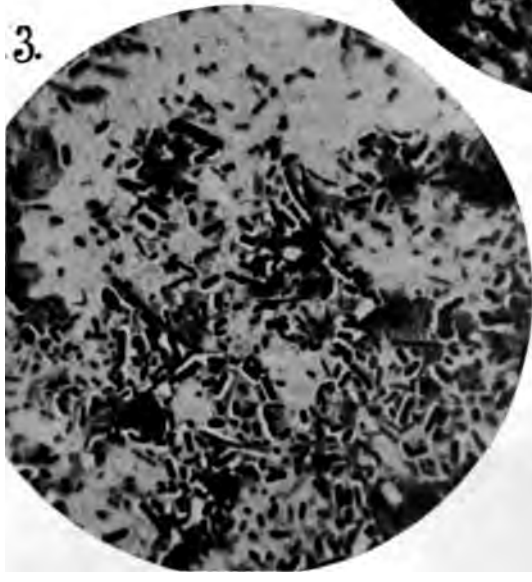
G. 1.

Photomicrographs of feces from three cases of advanced pyloric carcinoma showing Boas-Oppler bacilli in the stools. In all of these the organisms were most abundant in the gastric contents. The Boas-Oppler bacilli are seen as large segmented organisms slightly different in form in the three specimens.

In Fig. 1 they are shown with many of the other forms of fecal organism, among which

FIG. 2.

3.



their size easily distinguishes them, and in Fig. 2 they are the predominant bacilli.

Fig. 3 shows many short, thick rodded bacilli that may be mistaken for the Boas-Oppler, but the difference in size between these (bac. aerogenous capsulatus) and the Boas-Oppler will be noted by comparing the first with the second forms, about half a dozen of the Boas-Oppler being shown in the same field. × 1000.

tions, such was mainly because of a rightful conservatism in dealing with the vast and varied subject of the many forms of fecal bacteria encountered, and the fact that laboratory methods of study are different from existing conditions in the intestinal canal. Still, some facts have apparently been established which it is hoped will stimulate closer attention to this important subject. Several of such which are of practical value are herein contained.

Micro-organisms found in feces are divided into the two broad general groups of the aërobic and anaërobic, the latter being more largely concerned in the putrefactive processes. Of the first, the most notable example is the coli bacilli which can cause damage in two ways, as infective agents outside of the digestive tract and as infective agents inside of the canal. Inside of the canal they are probably concerned in the production of certain diarrheal conditions, although the dysentery, typhoid, and Shiga bacilli have also been found with them in many of the cases. Considering, however, that the B. coli have been found in large numbers in some acute dyspeptic diarrheal conditions (in which the others above mentioned were not), and that they are often met with in great abundance in excessive carbohydrate fermentations in the intestines, it is possible that an activity of the bacilli of this group in affecting the sugars and liberating irritative organic acids is of practical importance. This seems to be substantiated in the fact that the members of the coli group cannot initiate active putrefaction of the native proteids unless the putrefactive anaërobes, capable of peptonizing proteids, begin the hydrolysis, when the colon group can then become active. Other anaërobes concerned in the production of disorders are the typhoid, dysentery, Shiga, paratyphoid, the liquefying bacteria (of which the bacillus vulgaris is well known as capable of producing acute disease of the gastro-enteric tract, and which organism is probably actively concerned in producing indol, skatol, and the amido-acids from proteids), the streptococcal and staphylococcal forms, the bacillus bifidus, and others.

There is a fast growing belief that the strict anaërobes play an important part in the pathology of the digestive tract. Of these the bacillus putrificus is capable of actively attacking and hydrolyzing native proteids giving rise to the characteristic products of putrefaction, including butyric acid, hydrogen, hydrogen sulphide, and mercaptan, but probably not indol. A brother organism to this one, known as the paraputrificus, makes acids from sugars and does not cleave proteids. Herter believes that the B. putrificus is the most energetic anaërobe known in respect to ability to proteolyze native proteins, and suggests from a laboratory strain which produced large

quantities of indol in peptone bouillon that this organism in the inte tine might contribute in an important way to the production of ind The next anaërobe that has received much attention is the Bacill aërogenes capsulatus, which was first described by Welch, and t virulent form of which has a clinical significance in surgical a obstetrical diseases. This type of organism is a Gram-positive, ga making bacillus, capable, when injected into animals, of setting t localized neurotic inflammation with gas-production and toxemi These organisms are large, plump, usually straight bacilli, provid with a capsule, and are often found in the feces in cases of pernicio anemia in tremendous numbers. The gas they produce is from on third to one-half carbon dioxide and the remaining mostly hydroge When grown on a media which contains much sugar and but litt proteid, large quantities of gas are rapidly generated. In the presen of much proteid, the gas contains also butyric acid. It is probable th this group of organisms are not active indol producers, but they ha a powerful hemolyzing action on the blood freeing the hemoglobi The latter action is also noted with the B. putrificus but not to such marked extent. Because of the anaërobic nature of this organis Herter has employed, to cause their separation and note their presen the introduction and growing of this bacteria in the closed circulati of a rabbit. To this end, one or two cubic centimeters of filtered fe suspension is introduced intravenously into a rabbit and the anim promptly killed by a blow on the neck. The carcass is then incubat for from five to twenty-four hours at 37° C. when an autopsy is p formed. When many capsulati are encountered, the animal will most foul smelling from butyric decomposition, the abdomen and g eral carcass much distended with gas which burns with a blue fla the tissues are in a state of putrefactive liquefaction, and the bl heart, etc., contain bacilli of the capsulatus type, sometimes in alm pure culture.

Herter has pointed out that it is impossible to avoid the entra of bacteria into the digestive tract, and that the obligate bacteria (example, B. lactis aërogenes, B. coli, B. bifidus) adapt themselves the secretions of this part of the digestive tract and hold their o against newcomers. By virtue of their adaptability they ordina are not harmful to their host, but under some circumstances t are capable of doing service by giving rise to conditions that courage the growth of the harmful bacteria which cannot rea be excluded in food and drink. It is most probable that a nor acidity of the gastric juice checks the growth of many non-sporulat bacteria and is in a measure destructive to most varieties. Wh

on the other hand, the gastric juice or intestinal secretions are low or absent, a defective motility exists, or the bacteria are taken in large amounts (particularly into an empty stomach), there is a chance that some of them will find their way into the intestines. Speaking of the conditions which may be presumed to favor the development of the anaërobes so that large amounts of detrimental products would be absorbed, he says, "Especially important are influences which alter the character of the secretions in the large intestine or bring there unusually large quantities of partially digested proteid. In certain conditions of the digestive tract an excessive, or even a moderate, meal of proteid food will precipitate an intoxication or a seizure of vomiting or diarrhea. There are cases classed as ptomaine poisoning in which the digestive tract rather than the food is responsible for the observed disorders."

The putrefactive changes are produced largely by the anaërobic bacteria, of which the acidophilic forms grow best on a carbohydrate diet while the protein diet allows the proteolytic organisms to establish themselves and become predominant. These are encouraged in such states as carious teeth (which appear to be due to action of anaërobes whose growth occurs in the masses of food that lodge between the teeth), stagnant and insufficient HCl secretion, and excessive meat-eating. Herter suggests that the clinical manifestations of intoxications in the different types of poisoning from absorption of the intestinal products are explained by the individual cellular reaction of the patient rather than by the poison. In a half dozen patients suffering from indicanuria, one suffers from headache, sometimes migraine-like; another is prone to lumbago; another perhaps has epileptic seizures; another has mental depression; another progressive muscular atrophy, and another suffers from chylic vomiting. There is good reason to believe that in one person very similar processes in the digestive tract may lead to digestive disturbances mostly of the subjective kind, and in another, owing to a lesser sensitiveness in the digestive tract itself, to better absorption of the poisons and the development of more remote disorders, such as acute arthritis, anemia, nervous disorders, depressing melancholia, irritability, etc.

Of the chronic excessive putrefactions Herter believes there are three types of the condition:—

The indolic type, which seems to be due to members of the B. coli group, and is characterized clinically by marked indicanuria.

The saccharobutyric type, which seems to be initiated chiefly by the anaërobes, and in the simplest examples of which there is very little indol in the gut and urine.

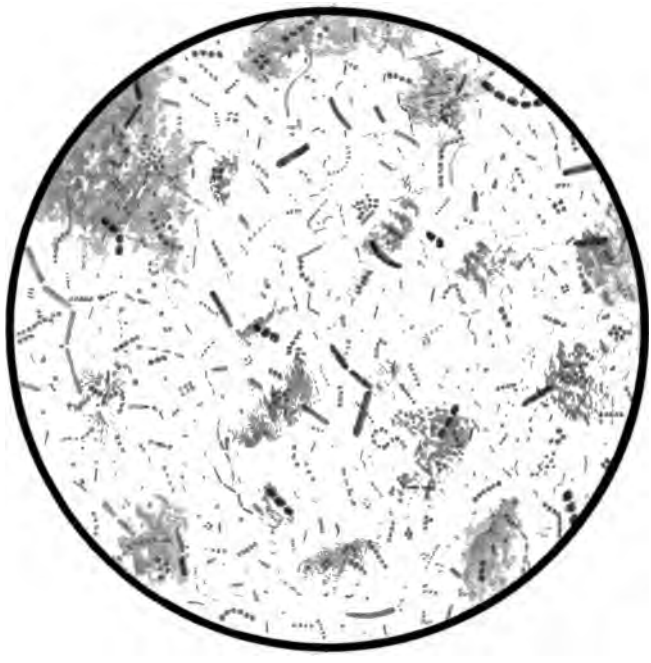
And a combined type, or cases combining the characteristics of the indolic and saccharobutyric forms.

Since there is so much of clinical interest in these, even in so far as the stomach itself is concerned both in the direct way and from a constitutional standpoint, it would not be amiss in this connection to consider these for a few moments.

In the indolic type, the members of the B. coli group form indol in large quantities and they probably invade the small intestine in large numbers, causing in their activity bacterial cleavages of proteids which largely replace the normal tryptic digestion. In this type of cases the digestive processes should be improved by proper measures both in so far as the gastric digestion and general health are concerned. The diet should be finally subdivided to insure quick absorption of the digesting products, the milk should be peptonized, and the colon irrigated daily to insure the removal of the putrefactive products before they are absorbed.

In the saccharobutyric type of excessive intestinal putrefaction, the putrefactive process is in the large intestine and lower ileum. It is due to the strictly anaërobic butyric acid producing bacteria of which the B. aërogenes capsulatus is probably largely responsible, although the B. putrificus and the bacillus of malignant edema may be found. The organisms attack carbohydrates and proteids vigorously and butyric acid is formed from both together, at times with propionic, caproic, or valeric acids. These are largely responsible in giving to the stools their unpleasant odor. The feces in those instances have a very low specific gravity, and often a very light color. From the proteids, besides the above mentioned acids, hydrogen, carbon dioxide, and perhaps methane are formed. The hydrogen leads to the excessive reduction of bilirubin and other pigments—thus the light color. The stools also have an acid reaction, although the acids are partly neutralized by the ammonia and other putrefactive bases formed. The Schmidt test with mercury bichloride gives a strong pink color. Indol is absent or present in small amounts. In the urine the ethereal sulphates may be present in excess, and mercaptan may be found in the feces which disappears as the patient improves. The presence of ammonium butyrate may give rise to irritation of the intestine, stomach and mouth. The patients suffer from flatulence made worse by both carbohydrates and acids and which may precipitate a diarrhea. These patients are physically more or less weakened, and have a distinct anemia which, in grade, may be all the way from a moderate secondary form to serious grades approaching that of pernicious anemia.

PLATE XXV.



A drop of feces from a case of gastro-enteric atrophy in which there was an absence of gastric juice secretion, a high albumin loss in digestion, a marked indicanuria in the urine, and an excess putrefaction in the colon. Stained by the Gram method. × 1000.

The combined types of the above in mild forms are the most common. Here there are many putrefactive anaërobes in the gut, and a persistent and well-marked indicanuria which is but slightly influenced by dieting. The nervous symptoms are prominent and appear early; emotional irritability or periods of mental depression and physical or mental activity soon induce fatigue. Later on, blood changes take place, which may finally approach that of pernicious anemia. At times these patients have intervals of improvement, but on the whole the tendency is downward. In well-established instances a more rapid advance to invalidism is noted than in the single types alone. When the atrophy of fat and muscle tissue and the blood changes are marked, there is the commonly present chronic parenchymatous changes in the kidneys and liver as a result of the constant poisonous action.

Lastly, and of the greatest importance in the diagnoses and treatment of stomach conditions, are the effects of these ethereal sulphates in secretion and motility of the stomach. I have pointed out and sternly maintained that the circulation of large amounts of these toxins have first a stimulating effect in raising the secretions and motility, and then a depressing effect in lowering them (the hypersensitive conditions of the stomach remaining always high). Close study of many of the cases of hyperacidity, hypersecretion, hypo- and anacidity, gastric and enteric atonies and dilatations, and hyperesthesia gastrica, gastralgia, enteralgia, etc., proves that these are very often resulting symptomatic states from the intestinal condition and not primary conditions of clinical entity of the stomach itself. Unless this is constantly kept in mind, only incomplete and transitory results from therapy can come in many of the cases.

As was mentioned before, the largest proportion of bacteria die in their passage through the colon, and thus only a small number can be cultivated from the stool. Moreover, the different portions of a stool have different quantities of bacteria. For these reasons Strasburger has devised a means of determining the actual dried weight of all the bacteria whether living or dead. It must be remembered, however that in this examination of the feces no distinction is made between the putrefactive and fermentative bacteria, and thus which form predominates must be ascertained by other means (cultivation, aldehyde reaction, litmus).

The diet is the most important factor in influencing the bacterial growth in the intestine. Foods that are digested and absorbed early in their passage through the gastro-intestinal canal leave but little residue for the bacteria to live upon, and consequently in such instances

the bacterial count will be low. When the reverse is the case (foods hard to digest, or when secretory disturbances of a lowered character exist allowing low normal conversion), the bacterial count will be high. The observations in full home diets give from 18.1 to 20.5 per cent. bacteria; full hospital diet from 18.2 to 21.1 per cent. bacteria; semiliquid hospital diet 15.6 per cent. bacteria; and milk diet gave 13.2 per cent. bacteria. These figures suggest the importance of dieting, as a remedy for excessive bacterial action in the intestines.

According to Strasburger, one-quarter to one-third of the dried weight of feces represents bacteria (these figures of course are modified according to the character and amounts of foods present in the intestine). In an average way one-quarter would probably be nearer to the ordinary individual, since many stools from normal persons contain less than this.

The bacteria are found in increased amounts in achylia, in excessive fermentative and putrefactive conditions in the gut, in poor starch digestion from any cause, in chronic cholecystitis, disease of the pancreas, and large mixed diets particularly when containing vegetables in excess, etc. The bacteria are usually found decreased in amount in habitual constipation of the atrophic and atonic types, when foods taken are low in amounts or only fluid or semifluid in character, and where, for stenotic reasons at the pylorus, in the esophagus or in the small intestine, but little food could be taken or would pass into the lower bowel.

The technique of the method which was so well described by Steele[2] is the following:—

"The possibility of separating the bacteria from the rest of the feces depends upon the fact that the bacteria are so nearly of the same specific gravity as distilled water that they cannot be centrifugated out of a watery suspension of the feces, but remain suspended in the supernated fluid. Taking advantage of this, the bacteria can be removed by washing with the centrifuge. Then if the specific gravity of the wash water is lowered by the addition of large amounts of alcohol, the weight relation of the bacteria to the fluid is changed to such an extent that the micro-organisms can be readily centrifugated out, separated, dried, and weighed.

"Unless the period of passage of the feces has been ascertained to be normal, it is better to mark the beginning and end of each period of examination by carmine. The use of the Schmidt diet is not necessary. Indeed, I have found that this diet is not desirable because it leaves very little residue, and so of itself reduces the total amount of bacteria to a lower point than that which is usually found.

"The whole stool is saved. Unless the feces are liquid they are rubbed up with a known amount of distilled water until they are smooth and semiliquid and as homogeneous as it is possible to make them. This is a modification of my own, intended to make it easier to obtain a specimen of the stool that is fairly indicative of the average amount of bacteria contained in each cubic centimeter. Strasburger takes but 2 cubic centimeters of the formed feces. It seems to me that since the different portions of the stool differ so in consistency and composition, this method of Strasburger leads to considerable error. I believe that my modification insures a much more accurate idea of the average consistency of the stool.

"Two portions of 5 cubic centimeters are measured off with a pipette of large caliber. I use for this purpose an ordinary 5 cubic centimeter pipette with the tapering end cut off, and with the necessary correction made at the mark. One of these portions of 5 cubic centimeters is put into a porcelain dish and dried upon a water bath and later in a drying-oven, in order to determine the dried weight. The addition of a little alcohol and thorough mixing will hasten the process of drying and prevent caking of the feces. The second portion is washed free from bacteria. This is done as follows: The wash water is 0.5 per cent. HCl solution in distilled water. The acid increases the solubility of the salts and soaps of the feces. I usually employ about 100 cubic centimeters of this solution at the beginning of the washing. The feces are thoroughly mixed with the wash solution and then centrifugated. The use of the water motor or electric centrifuge is almost essential. Each tube is centrifugated for about one and a half minutes; then the cloudy, supernatant liquid is poured through a layer of gauze. This fluid contains the bacteria in suspension. All of the mixture (the wash water and the feces) is centrifugated in the same way, and then the residue in the tubes is shaken up with more of the wash water and centrifugated again. This is repeated until the supernated liquid after centrifugating is quite transparent, showing that approximately all of the bacteria have been washed out. If a smear is made of the residue at this point, it will be found that the bacteria are not entirely washed away, but are evidently very much reduced. They occur singly, while in the unwashed feces they are in great lumps and masses. I do not believe that it is practicable or even possible to wash the feces entirely free from micro-organisms.

"Strasburger recommends that the wash water be centrifugated for a short time at high speed in order to remove any stray particles of solid residue from the suspension of bacteria. I believe this is a mis-

take, for if the decanting is carefully done in the first instance, then in my experience the sediment obtained with the second centrifugation is composed wholly of bacteria which would be lost if this part of the procedure was always carried out. The suspension of bacteria is then mixed with a liberal portion of alcohol and evaporated down slowly at a temperature of 40° to 50° C., until it amounts to not more than 50 cubic centimeters in all. This takes approximately twenty-four hours. It is then mixed with at least twice its volume of alcohol, preferably absolute alcohol, although this is expensive and not absolutely necessary. This lowers the specific gravity of the fluid to such an extent that now the bacteria readily centrifugate out. The mixture is then centrifugated until the supernatant liquid is quite clear. This may take thirty minutes or more for each tube. The residue, which consists of the bacteria, is washed with pure alcohol and is shaken up with ether to remove the fat; then it is washed out again with alcohol. All of this washing is done by means of the centrifuge. The bacteria are next washed out of the tube with a little alcohol and evaporated to dryness, dried in the oven at moderate heat, dried in the desiccator, and weighed. Smears of the final preparation show that it consists of bacteria with a few very minute particles of other material. These particles are only visible with high power and are very few in number, perhaps two to each field of the $\frac{1}{12}$ lens. They stain with methylene-blue, and Strasburger suggests that they are cellulose, which they may well be. At any rate, the error arising from the inclusion of these small particles in the dried weight of the bacteria must be very small, and is probably balanced by the bacteria that it is not possible to wash out of the residue in the first washing. During the preparation of the bacteria the first portion of 5 cubic centimeters has been dried and weighed. We then know the dried weight of 5 cubic centimeters, the weight of the dried bacteria in 5 cubic centimeters, the original volume of the stool, and the volume after the addition of a known amount of water. It is then easy to calculate the data we desire, namely, the volume of the stool, its dried weight, the weight of the dried bacteria, and the percentage of bacteria in the dried weight."

In considering the fermentative (decomposition of carbohydrate and fats) and putrefactive (cleavage of proteids) process from the standpoint of their products so many factors must be taken into consideration in the examination of feces that, as yet, only assumed importance can be deducted from the substances and amounts of them obtained. Leaving the urine having only indol and urorosein out of consideration, it must be recollected that the fermentative and putre-

factive processes usually overlap, and that substances in common (as carbon dioxide and volatile fatty acids) are found in both. Still substances containing sulphur or nitrogen, or both sulphur and nitrogen, are obtained in putrefaction and very probably form the important sources of toxicity from the intestines. It is known that carbon dioxide, methane, alcohol and the oxalates, are encountered in highest quantities in the fermentation of carbohydrates, and that in this is an element of practical significance, although it must not be forgotten that they may also be formed in putrefactive processes. Putrescin, cadaverin, phenol, cresol, indol, skatol, and the gaseous sulphur compounds—mercaptan and hydrogen sulphide—are more regularly found in increased amounts in the putrefactive conditions.

Our present-day knowledge of these substances does not warrant us in attaching too definite clinical conclusions on the finding of each one of these substances (excepting possibly indol and sulphurated hydrogen), and it is further unfortunate that the microscopical examination of the feces usually leaves us in the dark in the clinical way. Of them, however, some clinical deductions can often be made in the way of the gas formation from feces, which, of course, is due to the types and number of organisms, and amount and character of food present. I have observed that in health a dextrose-bouillon medium (2 per cent. sugar) inoculated with a floral suspension in normal salt solution will form between 20 to 30 per cent. (vol.) of gas to the height of the anaërobic limb in twenty-four hours. Herter has shown that in conditions of disease the gas-production was found to be considerably less than the average in health. In the case of well-marked examples of saccharobutyric putrefaction the gas-production may be one-half, one-third, one-fourth, or even one-fifth of normal. This he attributes to an elimination of the colon bacillus. When yeast organisms, or a growth of the bacillus lactis aërogenes are present the gas-production may be very abundant. In examining mixed flora, a diet containing large amounts of carbohydrates leads to a greater proportion of gas than a diet in which these are restricted. The fall of gas on a meat diet may be 40 or 50 per cent. of the total gas-production found in a mixed diet. These are facts which must be taken into consideration in interpreting the examination of feces.

The important gases obtained in the feces examinations are hydrogen, nitrogen, marsh gas, carbon dioxide, and sulphurated hydrogen. The varying proportions of these in health depends upon the character and amounts of foods, upon the character of the bacterial flora present, and the pathology of the digestive tract. Estimates of the amounts of the different gases obtained in feces in various diets

are: hydrogen 50 per cent. in milk, 2 per cent. in meat, and 3 per cent. in vegetables; nitrogen, 37 per cent. in milk, 50 per cent. in meat, and 15 per cent. in vegetables; marsh gas, .09 per cent. in milk, 31 per cent. in meat, and 50 per cent. in vegetables; carbon dioxide, 12 per cent. in milk, 10 per cent. in meat, and 27 per cent. in vegetables. Hydrogen sulphide is also always present (since it can be demonstrated in examining normal feces and produces sulphides from metallic medicaments in the intestines under all conditions—iron and bismuth salts, etc.). Carbon dioxide is partly due to alcoholic and butyric acid fermentation and partly to albuminous putrefaction. A portion is no doubt derived from the blood passing through the mucous membrane of the gastro-intestinal tract. In certain neurological conditions, mainly hysteria, large quantities of carbon dioxide is often discharged. Marsh gas is formed during the fermentation of cellulose, and a portion is derived from albuminous putrefaction. Hydrogen sulphide is produced early in putrefaction in the large intestine, and under pathological conditions (gastric dilatation) may be formed in the stomach and high in the small intestine.

Most of these gases when small in quantities are, no doubt, absorbed into the circulation probably without particular deleterious effect on the body. With hydrogen sulphide, however, there is much reason to believe that when it is absorbed in excess amounts it has a toxic effect on the nervous system, bringing on such symptoms as dizziness, delirium, mental depression, drowsiness, stupor, and collapse. In the saccharobutyric type of chronic excessive intestinal putrefaction butyric acid, hydrogen, carbon dioxide are formed (and often also methane).

Because of the fact that usually little of practical value can be gleaned from simply viewing Gram-stained specimens of the feces, and that more or less doubt generally exists in the gas tests unsupported by quantitative tests of the food content and the deficient bacteria that are present in living form (the last two of which are too complicated for ordinary clinical application), Schmidt has advanced a method of more quickly and simply noting the fermentative changes of foods on the basis of the continued digestion of the carbohydrates in the feces. Hewes and Adler,[3] who undertook an exhaustive series of observations on normal individuals to establish the reliability of the results obtained from the Schmidt diet in eleven individuals (6 in children and 5 in adults), claim a practical degree of constancy in the observations. They made quantitative determinations of the total nitrogen, total fat, and total carbohydrates, and of the total neutral fat, total fatty acid, and total soap in each of the cases in addition

to performing macroscopic and microscopic examinations of the feces in respect to the quantity and quality of the muscular fiber and starch remains present. Their findings of meat remains, as revealed by the capacity of the individual to digest meat, showed a constancy in both children and adults, and any one familiar with the normal findings can determine, by microscopic examinations of the feces, whether or not the results obtained were abnormal in the way of disturbance of meat digestion. The results of their proteid estimations expressed in nitrogen excretion are as follows:—

	Per cent.
Average finding in 17 examinations upon 11 individuals	4.98
Minimum finding in 17 examinations upon 11 individuals	4.41
Maximum finding in 17 examinations upon 11 individuals	5.40

The findings as regards fat absorption, determined by estimation of the total fat content, indicate that the capacity of normal individuals for the utilization of food fat may undergo considerable variation, as the following table shows:—

	Per cent.
Average finding of 17 examinations upon 11 individuals	28.5
Minimum finding of 17 examinations upon 11 individuals	19.2
Maximum finding of 17 examinations upon 11 individuals	39.5

The estimations of fat digestion, as determined by the proportion of neutral fat to total fat, gave fairly constant results in all of the instances.

Examinations of the carbohydrate remains were made on seven individuals, two of whom were children. The findings in the children and the adults were about equal as far as age was concerned, but there was a decided difference between the young and the older persons, the latter utilizing them to a greater extent. Their record of the carbohydrate excretion is shown in the following table:—

	Per cent.
Average finding of 7 individuals	8.01
Minimum finding of 7 individuals	6.39
Maximum finding of 7 individuals	11.3
Extreme variation in all cases	4.81

The results in regard to starch remains, as revealed by the microscopic examination of the feces, presented a striking uniformity in all the normal individuals examined.

The examination is made after the patient has been placed on the following test-diet (Schmidt and Strasburger's test-diet No. 2): milk, 15 liters; 3½ eggs; strained oatmeal gruel (from 80 grammes of oatmeal); 100 grammes of zwieback; 20 grammes of butter; 20 grammes

of sugar; 125 grammes of steak (raw weight), and 190 grammes of potato (raw weight). These foods can be given as one chooses, but before commencing with the diet it is necessary to demarcate the fecal material by giving a wafer or capsule containing 0.3 gramme of powdered carmine. The examination is made as soon as the feces are no longer colored red, viz., after from two to three days of the test-diet. A schedule of administration of the diet which serves to the purpose is as follows: At 7.30 A.M. ⅜ liter of milk and 2 zwiebacks (each 33 grammes); at 10.30 A.M. ⅜ liter of bouillon with ½ egg; at 12 M. ⅜ liter of milk with 1 egg; between 1 and 2 P.M. ½ liter of oatmeal gruel (prepared from 40 grammes of oatmeal, 166 grammes of milk, 10 grammes of sugar and ½ egg); 100 grammes of well-done Hamburg steak (125 grammes of raw beef, raw weight) and 12 grammes of butter; 250 grammes of mashed potato (from 190 grammes of potato, 60 grammes of milk, and 8 grammes of butter); at 4.30 P.M. ⅜ liter of milk, 1 egg; 1 zwieback; at 7.30 P.M. ½ liter of oatmeal gruel as at dinner time.

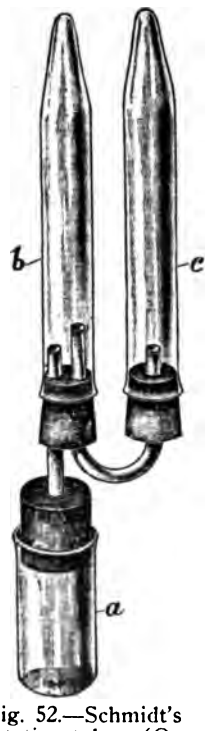


Fig. 52.—Schmidt's fermentation tubes. (One-third actual size.)

For each experiment 5 grammes of fresh feces are used (the feces being of medium consistence; otherwise a little more or less is taken corresponding to about 1 gramme of dry residue). The material is well stirred with water in the bottle *a*, which is then filled entirely and closed with the rubber stopper, care being taken to exclude bubbles of air. Tube *b* is filled with water and also closed without the admission of air. Tube *c* should be empty to allow displacement of the water from tube *b* as the gas collects in it; a small pinhole aperture at the top of tube *c* permits this displacement to occur. The communicating tube *d* is adjusted in the figure. The apparatus is then placed in the water-oven at 37° for 24 hours, not longer. During this time the carbohydrate fermentation will have been completed. During the evolution of gas, water will be displaced from *b* into *c* and the resulting column is measured and represents the degree of fermentation.

The result is regarded as positive if more than a quarter-tubeful of gas is obtained. With the test-diet in question this would mean

a condition approximately normal. In such an event the patient is placed for two days further on test-diet No. 1, which is the same as No. 2 with the absence of the meat and potato. If then there is still a positive result the diagnosis of "fermentative dyspepsia" is justifiable. In order to eliminate errors arising from possible formation of gas from intestinal albuminoid putrefaction the fermentating fecal material should be tested from time to time in a control specimen. If the gas formation is due to carbohydrate fermentation, there will be

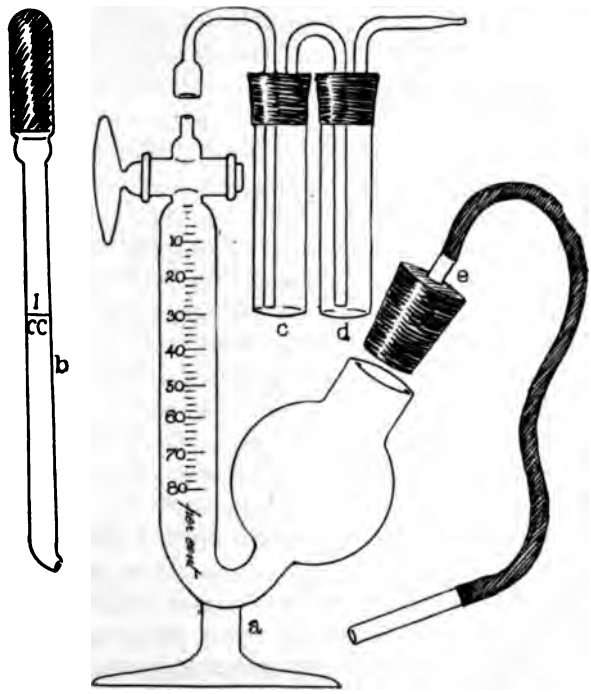


Fig. 53.—Author's gas, chemical and bacteriological apparatus for the examination of gastric contents and feces.

an increasing degree of acidity (tested with blue litmus paper); this increase, however, is not always marked; at any rate, there must be no increasing alkalinity (tested with red litmus paper).

The use of the Schmidt fermentative tubes answers to fair purpose in the practical way. Of course, the diagnosis of "fermentative dyspepsia" can be made by its clinical employment, but as to conclusions as to what this is due to with even a fair degree of definiteness usually remains somewhat of a question in the examination. This is partly due to the form of apparatus used to make the gas

examination. The Schmidt test-diet can be taken as about as perfect as it is possible to devise food values present in the gut for the estimations (although the more simple one advised below is much more practical of institution and just as efficient for the Schmidt test), but better media than plain water so as to permit of bacterial action upon them is desirable. Then again, it serves to some practical value in these tests to note which gases are present, or which ones are present in apparently increased amounts, and the desirability to have a graduated means to note more accurately than just one-fifth, one-fourth, or one-third volumes. For these reasons, and because the nutritive medias to permit of bacterial growth can be used, and a control is not necessary to note the reaction during the tests, I have employed for feces work the gasometer apparatus mentioned in connection with the examinations of gastric contents (page 189), and described below.

The fermentation tube is filled with a watery suspension of feces for the chemical test, or a 2 per cent. dextrose in bouillon or plain bouillon for the bacteriological test, or the unfiltered test-meal in the examination of gastric contents. In the case of the feces, 7.5 grammes of the soft end or part of the stool (corresponding to 1.5 grammes of the dried feces), or 5 grammes of the firmer, or about 10 grammes of the fluid, are thoroughly mixed in 25 cubic centimeters of water (the employment of a teaspoon is useful in crushing the feces, and it is desirable to remove the large particles of cellulose substances from the mixture). In the nutritive media a drop or two of the watery suspension or a loop or two of the feces itself is used to inoculate the tube. The fermentation tube is then placed in the water-oven, kept for twenty-four hours at a temperature of 37° C. when the observations are made. It often happens in the water suspension that when the tests are about to be made, much of the feces has risen to the top of the anaërobic limb and the gas will be seen incorporated with it. In these instances, the gas may be secured in a body by dropping a few lead shot into the bulb and then filling it to overflowing with water. A cork is then tightly fitted into the opening (so that no air is contained in the bulb) and the entire instrument is shaken so that the shot can split up the floating fecal mass. Before the cork is withdrawn, the gas from the upright limb that may have escaped into the bulb is passed back again into the upright tube by inclining the apparatus, after which the cork can be taken out, some of the excess fluid poured off, and the examination can proceed. First, the total gas result is noted, and then the quantity of carbon dioxide is ascertained in the watery suspensions by introducing into the upright tube, by

means of pipette *b*, 1 or 2 cubic centimeters of a saturated solution of sodium hydrate, and the tube is inclined so that this heavy solution is permitted to run somewhat high into the anaërobic limb. In from fifteen minutes to one hour all of the CO_2 will have been extracted from the gases present, and the rise in the fluid corresponds to the amount of this gas. The noting of the quantity of carbon dioxide present is not only of some value in the clinical way, but its extraction is necessary for the future observations.

The attachment with the twin bottles is now placed on the upright limb, and when the cock is opened the gases can be driven through the bottles by means of the attachment *e*. Bottle *c* is used to note the reaction of the gases. For this purpose it is three-quarters filled with a very weak solution of neutral azolitmin solution (using one-half of it in a test-tube for a control), or three-quarters filled with plain water in which are placed small pieces of phenolphthalein paper (to note alkalinity—turns red when ammonia is present), and methyl-orange paper (to note acidity—turns red with the volatile acids, butyric, acetic). In the use of the paper method, I would advise that one of the papers be cut in squares and the other triangles. Bottle *d* notes the presence of hydrogen sulphide. For this purpose, the bottle is three-quarters filled with a 10-per-cent. solution of lead acetate which turns dark or black from the formation of lead sulphide. The gases are blown through the bottles very slowly, preferably not more than one bubble at a time. A lighted match may be held at the end of the outer tube to note the presence of marsh gas, but as hydrogen is usually present and also burns with a blue flame and marsh gas is not of so much practical value, this part of the test may be omitted. Usually when marsh gas is present the reactions in the bottles are both positive. The elimination of the CO_2 in the first instance is essential because this gas is always present more or less, and gives an acid reaction in the reaction bottle, and also because it interferes with the burning of the gases at the outlet.

In the use of the watery suspension of feces the food values of same must be controlled by means of test-diets or the results would not be constant. For this purpose the Schmidt-Strasberger diets can be used, but the following which I employ is much easier and is practical for all of the feces tests—the food digestibility included. With this diet only a few meat fibers should be seen and the other elements be well utilized (iodine or Lugol's solution may be used to stain the starches). The diet list I give the patient is the following:—

Directions.—The diet mentioned below is to be strictly adhered to for three or four days. The stools of the first thirty-six hours after

its institution are of no value for examination. If constipation exists, the bowels are to be moved by injection, at the end of the thirty-six hours. After this time, providing the bowels have moved well, the entire first stool is to be sent as soon as possible, no purges being taken in the meantime. Fresh specimens are desirable, and a covered small tin can or a glass jar can be used as a container.

DIET.—*Morning.*—Two thin slices of well-baked bread with butter liberally applied; one pint of oatmeal gruel, made of about 1½ ounces or 40 grammes of oat meal, ¼ ounce or 10 grammes of butter, 6 ounces

Fig. 54.—Hart's food scale with adjustable food dial. Used for weighing food for the digestive power tests and the dietetic treatment of errors of digestion and metabolism. Made by Chatillon & Sons, New York City.

or 200 grammes of milk, 8½ ounces or 300 grammes of water and 1 egg (strained).

11 A.M.—Milk, 1 pint or 500 grammes.

Noon.—A good sized piece of steak, or roast beef, chopped or cut into very fine pieces (about 4 ounces or 125 grammes and served on a slice of toast; 1 bowl (about 8 ounces or 250 grammes) of mashed potato with ¼ ounce or 10 grammes of butter.

4 P.M.—Milk, 1 pint.

Night.—Same diet as breakfast.

With the use of the nutritive media the test-diets are a negligent feature since the results obtained pertain more particularly to the character of bacteria at work; thus I would advise the general

use of two fermentation tubes in each estimation, one for the clinical and one for the bacteriological tests. The fluid of the media tube can be used at the end of the testing to note the character of putrefaction (indolic or saccharobutyric) by the employment of the usual chemical methods and the two types of micro-organisms—the anaërobes in the closed limb, the aërobes in the bulb. When large quantities of the B. capsulatus are present in the gut, the gas result is high with one-half to one-third of it consisting of CO_2, and very little indol. While both in fermentation and putrefaction, CO_2 and the volatile acids are encountered, the sulphur and nitrogen compounds are not so, being only derived from proteid putrefaction. In the inoculation of the dextrose bouillon, 20 to 30 per cent. of gas may be considered as normal; in saccharobutyric putrefaction the gas content is usually only from 5 to 13 per cent. In gastro-enteric atrophy the gas content is high, running in my experience, in well-advanced cases, to 80 per cent. In the watery suspension of feces when food such as a normal individual ordinarily uses has been continued, and the proportion of feces and water employed as was mentioned above, the gas limits may be considered as from 10 to 30 per cent. On a meat diet it may fall to one-half of these figures, and on a strict carbohydrate diet it is usually higher.

References.

[1] Herter: "Bacterial Infections of the Digestive Tract."
[2] Steele: "Progressive Medicine," vol. iv, Dec., 1907.
[3] Hewes and Adler: Boston Medical and Surgical Journal, 1908, clviii, No. 19, p. 655.

CHAPTER IX.

Diagnostic Significance and Examination of the Blood and Urine in Gastric Diseases.

THE BLOOD.

THE examination of the blood in a general way is not of as much diagnostic value in gastric diseases as it is to separate these from other diseases in which gastric symptoms exist. Still, certain blood changes commonly accompany several of the primary stomach and intestinal affections, and since these may have some diagnostic and therapeutic significance they should be mentioned.

It is probable that in the years to come some practical facts will be established in the examination of the blood which will serve to make possible diagnoses of carcinoma of the internal structures of the body. It has always appeared to me (since I believe that cancer is parasitic in origin) that the light will dawn either by way of the direct examination of the blood, or by the urine for some specific toxic substance. In the mass of past work and literature upon the subject, it may be stated that but little of diagnostic importance is to-day on hand. Still, some laboratory facts have been gleaned as rather constant features, although, unfortunately, a negative or a positive result from any or all of them cannot definitely be used to either exclude or make a diagnosis of cancer. Up to the present time these briefly are the following:—

Sugar is a normal constituent of the blood where it is present in amounts varying between 1 and 1.5 pro mille. This substance is increased in amounts in diabetes, and to a less extent in carcinoma and the infectious diseases. According to Drinkler,[1] large quantities of reducing substance, most of which is sugar, is met with in carcinoma of the internal organs, and this increase can be utilized to differentiate cancer from sarcoma, in which latter condition it is lacking. This observer, following Freund, states that in carcinoma the average percentage increase is double that of typhoid fever and pneumonia, running in figures between 0.1023 and 0.3030 per cent. It is probable then, since none of the other diseases (excluding diabetes) gave a maximum per cent. much over 0.1, that 0.2 per cent. or more would argue in favor of cancer.

The procedure of these estimations (Cavazzani) is to obtain 20 or 30 cubic centimeters of blood by venesection or aspiration of one of the arm veins (median-cephalic), and to free the blood from proteids. To this end, the known quantity of blood is added to 200 cubic centimeters of distilled water in a porcelain dish, treated with 5 or 6 drops of a solution consisting of 10 parts of acetic acid (sp. gr. 1.040) and 1 part of lactic acid. The mixture is boiled for about ten minutes, filtered, and the coagulum repeated, washed with hot water and finally pressed out in a piece of muslin. The filtrate is evaporated to a small volume over a water bath, and if necessary further cleared of albumin by again filtering, or the addition first of a few crystals of sodium carbonate when the reaction is distinctly acid, or a few more drops of acetic acid if it is not. In the final filtrate the sugar is estimated by the usual methods as employed with urine.

In the secondary anemia of carcinomatosis the color index is usually low, and the oligocythemia permanent and in degree depending upon the course of the disease, although it is rarely as low as in pernicious anemia with which an achylic stomach is commonly also present. A granular degeneration of the red cells is more or less constant, although not so marked a feature as in pernicious anemia, lead poisoning, and malaria. Poikilocytosis is usually constant depending in the degree of anemia according to the advance of the disease, but the megalocytes and megaloblasts are rarely observed and, if so, are very few. In pernicious anemia these latter cells are characteristic findings.

A physiological hyperleucocytosis is observed during the process of digestion, reaching its height between the third and fourth hour after the ingestion of foods. The increase in leucocytes affects the polynuclear elements and the lymphocytes (especially the latter), and the increase may be considered as up to 3500 in normal adults depending upon the amount of proteid content in the foods. Under certain pathological conditions, notably cancer of the stomach, this digestive leucocytosis may not occur, and this was advanced by Schneyer as a factor of assistance in the diagnosis of this disease. While this digestive increase in the white blood-cells is commonly absent in gastric cancer, in about 10 per cent. of the cases it is seen even quite late in the disease providing the pylorus is patent and the chemism of the stomach is somewhat preserved. In the benign stenotic conditions of the organ the presence of a digestive hyperleucocytosis is the rule, while in the marked stagnant conditions of the organ (which are almost invariably malignant), a raised leucocyte count is rarely present, and if so the increase seldom reaches to an

additional thousand or more. To observe this, the first blood-count should be made with the patient in bed and after having fasted for about seventeen hours at which a test-meal of a pint or more of milk and one or two eggs should be given, and the second or third blood-count made three or four hours afterward. It should be remembered that if much ulceration accompanies the malignant process, the primary count may be high and the digestive hyperleucocytosis apparently present may be from stimulation of the septic area and resorption of fluids from the foods. A high leucocyte count commonly exists when much gastric hemorrhage is present.

In acute gastric ulcer a low color-index and red-cell count is seen in the majority of cases, particularly after a hemorrhage of some extent (at these times the white-cell count may be high). Poikilocytosis is rarely present unless the bleeding has lasted for some time when the secondary anemia may be marked and a few malformed cells be observed. When chlorosis exists, an oligochromemia exceeds the corpuscular loss, and the color index may have fallen to 0.3 or lower. Other cases again display no change in the blood examinations, and particularly is this true in the post-acute ulcer conditions and in the chronic ulcer.

In both acute and moderate grades of chronic gastritis the red cells are not diminished. In the severe types of the chronic disease an oligocythemia and blood picture of red-cell degeneration may be so marked as to make a differentiation most difficult between it and true pernicious anemia. Occasionally in chronic gastritis granular red cells are seen with granules of the larger type, such as are characteristic of pernicious anemia. Poikilocytosis is common in the cases of gastro-enteric atrophy, but with the low color-index, the fact that the red-cell count is usually not under 2,000,000 (Henry[2] gives 1,500,000 as the limit), and megalocytes and megaloblasts are not encountered. serves to distinguish the blood from that of primary pernicious anemia. In suppurative gastritis a hyperleucocytosis is of rather constant occurrence, or the neutrophiles are relatively increased and the eosinophiles much decreased or absent altogether (the latter is the so-called septic factor of Simon[3]). In a fatal case of phlegmonous gastritis due to streptococcus infection, I observed a leucocyte count of 32,000, and I believe that the blood-examination in these difficult-to-diagnose cases is of inestimable value in diagnosis.

In the neuroses, unless a simple anemia is present, no practical data can be gained from blood-examinations. The same may be said of primary gastric sarcoma until very late in the disease, or in the metastatic forms even to the very end. One of my cases of multiple

sarcomata in a man (which came to autopsy and had twenty-seven sarcoma nodules in the stomach walls), had a red blood-count of 3,700,000 and a color-index of .79 and a white cell-count of 9100 only three days before death.

In these examinations much information may be gained quickly by the examination of a wet mount, in which, after a little practice, a fair idea of the grade of the anemia, the degree, character, and extent of a hyperleucocytosis may be obtained, as well as malarial parasites seen. The lobe of the ear or tip of the finger should be deeply punctured by a lancet or a Hagadorn needle so that the blood flows freely, and the observation made (between a slide and cover glass) before crenation has occurred. Fixation and staining of dry mounts are always essential for more detailed examination. The blood-counting apparatus of Thoma-Zeiss for both the red and white cells is the apparatus of choice for enumerating the blood-corpuscles, and the hemometer of Fleischl or Dare is clinically the most convenient for the hemoglobin estimations. For fuller details on the methods and technique of blood-examination the reader can consult some work on blood-pathology or clinical diagnosis.

THE URINE.

Although but little can be gained from the examination of the urine in primary disease of the stomach, still, this detail of examination should never be omitted because of its diagnostic value in constitutional disorders, local disorders of the kidneys, intestines, heart, liver, and so on, which, in the case, may be presenting gastric symptoms. The significant features of urinalysis in gastric disorders, mostly, will be considered.

The quantity of urine is commonly increased in diabetic conditions, in arteriocapillary sclerosis, in amyloid disease, and in functional disorders of the nervous system—particularly in hysteria, chorea, and migraine. In arterial sclerosis of the splanchnic area a moderate increase in the amount of urine is an important symptom. It is rare to find in the primary gastric neuroses (even when of marked degree) any noticeable difference in the amount of urine voided, but in atonic conditions of the stomach (in which excessive thirst is common) the amount of urine will be correspondingly increased. No accurate conclusions of the degree of motor disturbances as judged from the quantities of urine voided can be made, since even in stagnant conditions of the organ where high degrees of dilatation and atony exist the urine may be normal in quantity. Oliguria, on the

other hand, is often met with in digestive disorders. It is common in debilitated and asthenic subjects probably because of low blood-pressure, weak heart action, or the taking of insufficient fluids. Following diarrhea, persistent vomiting, or hemorrhage, a low urine excretion is the rule, and this is also true in a running way in the low-continued fever of carcinoma, or when a secondary nephritis had been established from organic or malignant disease elsewhere in the body.

Normally, the reaction of the collected urine of 24 hours is acid, and the degree of acidity is greatest in the morning, and in concentrated urines. If the diet consists purely of vegetables, or after the ingestion of a large meal of any kind of food, the reaction may be temporarily alkaline. This digestive change in urine reaction is taken advantage of to diagnose the status of gastric secretion, but in my experience results from it are far from satisfactory. It has been advanced that when after a meal the urine loses part of the acidity or becomes alkaline, hydrochloric acid secretion exists depending in amount upon the degree of acid loss in the urine, or that organic acids are being formed in the stomach; and *vice versâ*, that when this physiological lowering of acidity is not present in urines after the ingestion of the principal meal it speaks for deficiency or absence of HCl secretion. While these urine conditions are so in the majority of such cases, still, so much variation exists that definite conclusions should never be made from the urine examination alone; these are due to the quantities and character of foods taken, and the fact that this rise and fall of urine reaction, in even normal individuals, may not exist to any appreciable extent. I have observed anachlorhydric cases with an evenly running low acid or fixed alkali urine, and cases of increased secretion wherein but slight if any lowering of the post-meal acidity of the urine could be noted. It is also probable that in certain anemic, neurasthenic, or debilitated individuals this rise and fall of acidity is interfered with by the low running grade of acidity seen in these conditions. In persistent vomiting and severe motor disturbances of the stomach the urine is often alkaline.

The total acidity of urine can be estimated, according to the Folin method, as follows: 25 cubic centimeters of fresh urine are treated with 1 drop of ½-per-cent. alcoholic solution of phenolphthalein and 15 grammes of powdered potassium oxalate. The solution is well shaken, and triturated at once with decinormal sodium hydrate solution (under constant agitation) until a faint pink is obtained; the result represents the acidity due to diacid phosphates and free organic acids, and is figured in total amount of urine voided in twenty-four hours, and is expressed as T.

The next step is to determine the total phosphates, the value being termed P. For this are employed a solution of uranium nitrate of such strength that 20 cubic centimeters shall correspond to 0.1 gramme of P_2O_5; a solution containing sodium acetate and acetic acid; and a tincture of cochineal. Fifty cubic centimeters of clear, fresh urine are treated with 5 cubic centimeters of the acetic-acid mixture, the object being to transform the monoacid sodium phosphate present into diacid sodium phosphate and to neutralize any nitric acid that may be formed during titration. A few drops of cochineal tincture are added, the mixture heated to boiling, and then titrated when hot with the uranium solution. The results are calculated according to the amount of uranium solution used. For example, if 15 cubic centimeters of titrating solution are employed, the P_2O_5 in 50 cubic centimeters of urine is found from the equation: $20:0.1::15:x$; and $x=0.075$. The percentage amount would then be $0.075 \times 2 = 0.15$, and if the total amount of urine was 2000 cubic centimeters the elimination of P_2O_5 would be 3 grammes.

For the final result for computation between the two foregoing estimations, an expression of the latter in terms of decinormal acid is necessary, viz., alkali as in the first (1 c.c. $\frac{N}{10} = 7.1$ mgs. of P_2O_5).

The T minus P indicates the acidity due to uncombined organic acids, and the difference the mineral acidity. The average figures which Folin obtained in twenty-four-hour urines from normal individuals was 617 (c.c. $\frac{1}{10}$ N. acid, viz., alkali), of which 304 represented mineral and 313 organic acidity, and these figures may be considered as a standard for estimations.

The total phosphates, estimated as above, are often found increased in sufferers from digestive disturbance. The normal amount secreted in twenty-four hours usually runs between 2 and 3 grammes, but in states of excess HCl secretion, anemia, in nervous individuals, and carcinoma, this may run as high as 6 to 12 grammes.

The chlorine content of urine, in the diagnosis of digestive disorders has received more attention than the other inorganic substances. This was probably because of the presence of HCl secretion in the stomach and the hope that some facts of diagnostic value might be gained concerning this. Unfortunately the observations reported in the total chloride estimations leave much to be desired, or the estimations cannot be taken as of much practical value. In the greater number of instances of hypersecretion, gastric ulcer, atony,

and carcinoma the chlorides are considerably diminished, but this cannot be depended upon as always being so, and, consequently, I have discarded these estimations as a measure of diagnosis or observation in these conditions. In diarrhea, anemia, the nervous affections, and infectious diseases (particularly pneumonia), a decrease is commonly encountered. The Salkowski-Volhard method serves to the best advantage in these estimations.

Sulphuric acid occurs in urine in two forms: first, the mineral sulphates in combination with sodium and potassium; second, the organic sulphates in combination with indol, skatol and phenol—the first are termed the inorganic or preformed sulphates, the latter the conjugate or ethereal sulphates. The total daily excretion of both varies between 2 and 3 grammes, and the relation between the preformed and conjugate combinations is respectively as 10 to 1.

In the study of digestive diseases the preformed sulphate examinations may be disregarded as they are not of value excepting should the ratio between the two kinds wish to be ascertained (such as in a high increase in the conjugate form), and thus only the relative importance of the preformed form (indol) will be considered. When albuminous substances are undergoing putrefaction in the intestine, or rapidly decomposing in any part of the body, as in accumulations of putrid pus, septic peritonitis, empyema, etc., indol is formed. This substance when absorbed into the circulation is oxidized, forming indoxyl, and the latter unites with the preformed potassium sulphate to become the conjugate potassium indoxyl-sulphate, or, as it is commonly termed, indican. If indican, which is colorless, is treated with strong acids and oxidizing agents it is decomposed with the formation of indigo blue, the color of which is readily recognized.

Indol, urohematin and urorosein, in my opinion, possess much significance in the diagnosis and therapy of digestive diseases. But since in this volume we are concerned chiefly with disorders of the stomach, their direct importance in intestinal disorders will not be included, and only their effects in the production of gastric symptoms will be considered. In entering upon this, the author wishes to express his belief that these products, when present in the circulation for a length of time (as they commonly are in the putrefactive conditions of the intestines), have a depressing effect upon the secretory apparatus of the stomach and the general nervous system, and may cause low degrees of nutritional changes in the body, all of which may be strong factors in the production of gastric symptoms. After a rather close attention to this subject, I cannot agree with many of the well-known authors on gastric diseases in the way of accepting the

condition of indicanuria in any negative or light vein in the diagnosis or therapy of stomach disorders. It is doubtless true that when indicanuria was first advanced as of significance, too much hope had been built up on the presence or absence of increased amounts of indican in the differential diagnosis of intestinal conditions. It must never be forgotten that these products merely represent intestinal putrefaction, and that this may or may not be present in any disease of the intestines even in cancer. But while this is true, such states in which increased amounts of indican (or allied substances some of which no doubt are still unknown) may be the cause of gastric symptoms which will not progress favorably unless the primary source of the excess indican had received attention. Excess production of indican then is of importance in functionally producing gastric symptoms, and tests for this should never be omitted in the diagnosis of stomach disorders. As our knowledge of the present day is still somewhat hazy on the entire subject of these putrefactive products, and the tests for indican are the simplest and best known, those for this substance have to be considered as most representative and diagnostic of these conditions.

Indican is present in small quantities in healthy urines. According to Simon, and to which I fully agree, an excess secretion of indican is often indicative of a decreased proportion of hydrochloric acid in the gastric juice, and leaving out of consideration the direct and transitory inhibitory effects of indicanuria upon the stomach secretion, an excess secretion of indican may be found in low or absent gastric juice secretion (such as may be found in hypochlorhydria, anachlorhydria, or achylia), in acute and chronic gastritis, gastro-enteric atrophy, cancer, and in disease or obstruction of the small and large intestine even when the stomach secretion is normal. But it is also true that a high output of the ethereal sulphates may exist with the sthenic conditions of the stomach, namely, acute congestions and inflammations and the hyperacidities, hypersecretions and even hypermotilities. For these reasons an indicanuria cannot be taken as indicative of an asthenic stomach condition for the reason that in most of the instances the indicanuric condition at first accelerates the stomach functions before it depresses them. Clinical experience has proven to me that in most of the cases of chronic intestinal putrefaction of the indolic and combined forms the low status of stomach function noted, even to stomach and intestinal atonies, are resulting rather than causative states. My reasons for this belief are mainly because high indicanuric states with hypersecretion and hypermotility are even more commonly encountered than are those with impairment of stomach function, and that an improvement in the intestinal condi-

tion also often shows a secondary beneficial change in the stomach. A high proteid diet usually increases the output of the ethereal sulphates, and a carbohydrate or exclusive milk diet usually diminishes it.

The most generally used test for indican is by means of the Obermayer reagent, which is a 2 pro mille solution of ferric chloride in concentrated hydrochloric acid. A few cubic centimeters of urine (about 5 cubic centimeters) are mixed with an equal volume of Obermayer's reagent, and shaken with a small amount of chloroform (about 1 cubic centimeter) which last takes up the indigo blue which is shown after the test-tube has stood for a few moments (until the chloroform settles to the bottom); it may be concluded that a colorless or a light sky-blue chloroform is normal, and that a darker blue represents an excess. I observed a urine from a post-operative case of ileus in which the chloroform was almost black, and in this instance the urine examination was the first suggestive finding.

Another test for indican which answers the purpose admirably is the Stokvis modification of the Jaffé test. To this end 5 cubic centimeters of urine are treated with an equal amount of concentrated hydrochloric acid and 2 or 3 drops of a strong solution of sodium or calcium hypochlorite or about 2 cubic centimeters of hydrogen peroxid are added. Chloroform is added as above, and the mixture shaken and permitted to separate, when the colored chloroform can be noted. In both of these tests I believe that better results are obtained by first making the mixture, shaking it well and letting it stand for a few moments before adding the chloroform and final shaking. After performing the test a few times, the color values of the various amounts of indigo blue will be learned, and thus a practical idea of increased amounts is obtained. Marked tubes containing various amounts of indigo blue in chloroform solution may be made and used for comparisons; at these times the same quantities of urine, reagent, and chloroform should always be used in making the color comparisons, and Jaffé's observation of the mean average of healthy urines may be used as a standard (6.6 milligrammes in 1000 cubic centimeters of urine).

Urohematin (indigo red) is most likely an indoxyl derivative with a clinical significance similar to that of indican. It is more rarely observed than indican, and may be noted in extensive disease of the small intestine affecting resorption, in gastric cancer, and acute and chronic peritonitis (Ewald). It is also met with in ileus, chronic intestinal putrefaction and small intestine obstruction, and, like indican, it is rarely observed in carcinoma and stricture of the colon and esophagus, chronic diarrhea, etc. It is present in normal urines

n small amounts, and may be demonstrated by shaking urine with chloroform (about 4 to 1 per volume), decanting it after agitation during several days, when the addition of a drop of concentrated hydrochloric acid to the chloroform will cause the appearance of a rose color—the deeper the red the greater the amount of chromogen present.

For the reason that urohematin may be present without an increased amount of indican, the general employment of the Stokvis-Jaffé indican test (above described) is recommended as a routine for the above mentioned substances and also uroroseinogen. Usually, however, both indican chromogens are present together when a purplish color will be obtained in the chloroform extract. The so-called "Reaction of Rosenbach" is a simple and most convenient test for indigo red, and by it tests for both albumin and this substance in increased amounts are noted. It consists of simply boiling the urine in a test-tube and adding drop by drop concentrated nitric acid, when in the presence of large amounts of indigo red a dark Burgundy color is noted. The color may be bluish when viewed in the direct daylight, and usually fades out when more than 10 or 20 drops of nitric acid are added (this, of course, is also the common urine test for seralbumin). In the quickly made tests for indigo red no red color of the substance is noted in normal urines.

Uroroseinogen (urorosein) is another chromogen that may be found in urines. It is also red in color, and is probably a derivative of skatol. It is best tested for by the Stokvis-Jaffé method above described, when the indican present will be seen in the chloroform below, and the urorosein above in the supernatant fluid which it colors a beautiful rose color. The latter may now be extracted from the supernatant fluid with amyl alcohol and separated from the other pigments that may be present at the same time by shaking with sodium hydrate at which the solution is decolorized. Upon the addition of one or two drops of hydrochloric acid to the alcoholic extract the red color of urorosein reappears, quickly fading out on standing. It is interesting to observe that while indican is a representative product of albuminoid putrefaction in the intestines, urorosein is more commonly found in the fermentation of vegetable substance in like cases. The following brief history of a case is offered in this connection:—

E. M.—(Referred by Dr. W. Freil, Jersey City.) Female. Single. Age, 38. Mother died of uterine cancer at 42; father of acute enteritis at 51. Weight, 83½ pounds.

History of Present Illness.—Began with a red ulcer on tongue 6 years ago, following which she began with gastric symptoms. In past 11 months has been

nauseated constantly and had severe attacks of vomiting lasting several days; has a fitful appetite; sometimes a diarrhea, but never markedly constipated. Always feels full in the abdomen; has gas in stomach and bowels; lost 21 pounds in last 4 years, and 15 pounds in last 8 months, and 6 pounds in 2 weeks.

Examination.—Pale, emaciated, and physically weak; looks very ill. Tongue red and clean; lungs and heart negative. Growth in epigastrium just above the umbilicus, which feels like a mass sharply limited to pylorus. Stomach markedly dilated and distended, no peristaltic waves visible.

Tests.—Ewald meal, 25 cubic centimeters return, negative acidity to acid papers; lactic acid and blood present; mucus in excess; no Boas-Oppler, but many micrococci and leucocytes. Free HCl 0, total HCl 7°, total acidity 12°. Urine, specific gravity 1016, acid, clear, amber, trace of albumin, no glucose, large amounts of indican, no red pigments.

Diagnosis.—Gastric carcinoma.

I saw the case again 5 months afterward, when she had gained 15 pounds in weight; her epigastric mass had disappeared; her gastric symptoms had abated but her intestinal symptoms were more marked (diarrhea, flatus, etc,), and she was if anything, physically weaker and was being assisted about. Her feces showed a high albumin loss, and her urine but little indican but large amounts of urorosein—she was taking practically only cereals, vegetables, milk, and eggs at the time; it had ½ per cent. per vol. of albumin, many casts, 5 grains of urea to the ounce, and many oxalate crystals. Her blood-count was 2,250,000 reds, 23 per cent. hemoglobin, color index low, 7.100 whites. The morphology of the red cells was much like that of pernicious anemia without megalocytes or megaloblastic cells.

The diagnosis was changed to gastro-enteric atrophy, and the mass at the pylorus was assumed to have been due to a pyloritis incident to atrophic disease, and which condition finally advanced into the intestinal canal involving the entire digestive tract and probably the pancreas as well. The main interesting features of the case were the presence and then the disappearance of the gastric thickening, and the chromogen change in the urine as the condition advanced.

The distinctly pathological pigments that may be noted in the urine are those of bile and blood. Of these in digestive diseases the coloring matter of bile (bilirubin) is of vast diagnostic significance. As is well known this chromogen never appears in urine when it is being passed off in the natural way in the feces. But when obstruction in the bile ducts exists, either catarrhal (gastroduodenitis), stenotic from adhesions of the common duct, when plugged by stones, pressed upon by neighboring organs, or growths in them, etc., a small portion is reabsorbed into the blood and thus eliminated in the urine. Usually the presence of bile can readily be recognized by the color it imparts to urine, its foam when shaken, or sediment when standing. Occasionally, however, doubt exists as to its presence particularly when this is so in only small amounts, and thus chemical tests for it may have to be made.

Among the many of these advanced are those of Smith and Gmelin—the first being by far the more sensitive and satisfactory.

To perform the Smith test, 5 to 10 cubic centimeters of urine are placed in a test-tube and treated with 2 or 3 cubic centimeters of tincture of iodine which had been diluted 1 to 10 with alcohol. This dilute iodine is carefully floated on the top of the urine at which when bilirubin is present an emerald-green zone is noted at the point of contact. The Gmelin test may be performed by allowing a few drops of nitric acid to run down into a small quantity of urine in a porcelain dish at which a green color is noted as it flows into the urine, or the acid can be delivered with a pipette into the bottom of a test-tube of urine at which the well-known play of colors is noted of which the green is the most characteristic.

Blood likewisely can readily be recognized in urine, and the color it gives to the sediment. When red blood-cells are present, an examination of a centrifuged portion by the microscope is a quick and reliable method. The chemical tests for hemoglobin in urines are the well-known Heller's and Donogany's. A blood derivative known as hematoporphyrin may be present in larger amounts than normal. When so, it usually colors the urine a brown which is deepened on standing. To demonstrate the presence of the substance the Garrod method should be employed.

Blood in the urine is rarely met with in the routine of gastric diseases. Occasionally it is noted in multiple sarcomata when deposits are in the kidneys, and late in gastric cancer in very small amounts. Slightly increased amounts of hematoporphyrin are sometimes met with in ulcerative, hemorrhagic and malignant conditions of the intestines. Altogether, the presence of blood in the urine possesses no special significance in the diagnosis of diseases of the digestive canal.

The condition of nitrogen in the urine in digestive diseases is of some significance particularly when its output is low. This is noticed in some of the cases of cancer of the stomach and in hepatic and renal disease—such as acute yellow atrophy, cirrhosis, insufficient excretion of bile, interference with the circulation in the portal system, Weyl's disease, and in nephritis. Nitrogen itself may be quantitatively estimated by means of the Kjeldahl method (normal output 3 to 4 grammes per diem), or the urea, which represents about 85 per cent. of total nitrogen eliminated by the kidneys, may be used in making the examinations (normal output between 30 and 35 grammes per diem depending upon the amount of nitrogenized foods taken and the body metabolism). It has been reported that the urea output in cancer and particularly cancer of the stomach may fall as low as 7 to 14 grammes. As in all other conditions of the stomach but little or no effect on the output of nitrogen is noted (providing, of course,

that sufficient proteid food is being taken), this examination may be utilized in differentiating cancer from the benign conditions particularly in pyloric stenosis. In deficiency of hepatic function for any reason or interference with the flow of bile the urea output runs low (from 10 to 20 grammes) and the uric acid output high (from 1 to 2 grammes), the normal amount per day of the latter being about 0.7 gramme.

The Kjeldahl method for quantitatively estimating nitrogen de-

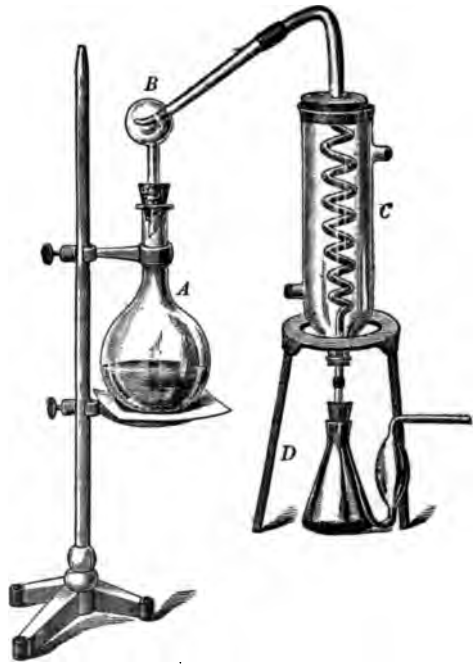


Fig. 55.—Kjeldahl's nitrogen apparatus.

pends upon the fact that all organic matter is decomposed by sulphuric acid, when all the nitrogen which is not present in combination with oxygen is transformed into ammonia. The ammonia is secured by distillation, and the quantity of nitrogen is figured from the amount of ammonia present, remembering that 17 grammes of ammonia corresponds to 14 grammes of nitrogen.

To these ends is required a retort of about 750 cubic centimeters capacity (A), which is connected with a Kjeldahl distilling tube (B), and through this with a Städeler condenser (C). The nitrogen is received in the nitrogen bulb (D). A Kjeldahl digesting flask is also

required. The reagents required are a mixture of 100 grammes of phosphoric anhydride in 500 cubic centimeters concentrated sulphuric acid, a solution of sodium hydrate containing 270 grammes in the liter (sp. gr. 1.243), a one-fourth normal solution of sulphuric acid, a one-fourth normal solution of sodium hydrate, and some pulverized talcum or granulated zinc to prevent frothing or bumping. The procedure is as follows:—

Five or 10 cubic centimeters of urine, a measured quantity of feces in water, or about 40 cubic centimeters of the saline instillation in the performing of the Solomon test, are placed in the digesting flask and treated with 0.4 gramme of mercuric chloride, well shaken, and then with 10 cubic centimeters of the sulphuric acid—phosphoric anhydride mixture. The digesting flask is then heated until the contents become clear and almost colorless. The flask should be inclined at an angle of about 45 degrees and vigorous boiling should be avoided. Toward the end of digestion a few crystals of potassium permanganate are added to insure complete oxidation.

Upon cooling, the contents of the flask are transferred to the retort, with the aid of a little distilled water, and slowly treated with the sodium hydrate solution in the proportion of 40 cubic centimeters for each 5 cubic centimeters of sulphuric acid. A little pulverized talcum or a few pieces of granulated zinc are added, the retort is connected with the distilling tube and the distillation begun. This is continued until two-thirds of the solution have passed over into the nitrogen bulb in which is carefully measured 30 cubic centimeters of the one-fourth normal solution of sulphuric acid. The condenser is washed clean and the washings added to the distillate. After the addition of a few drops of dimethylamidoazobenzol the excess sulphuric acid is retitrated with the one-fourth solution of sodium hydrate, and the amount found deducted from the 30 cubic centimeters used. The titration is carried on until the last trace of red has given way to a yellow. The difference multiplied by 0.0035 will indicate the amount of nitrogen present in the quantity of specimen examined; and in the case of urine, the amount of urea is found multiplying this figure by 20.

The albumins which may be met with in urines are serum albumin, serum globulin, albumoses (peptones), and others. Of these, serum albumin and peptones are of the most clinical importance. Albuminuric urines are commonly met with in gastro-intestinal conditions. Leaving out of consideration the transitory or physiological (?) conditions in which albumin may be found in urines—severe muscular and mental labor, cold baths, etc.—pathological albuminuria

(constant presence) may be found in a number of medical conditions, among which are: nephritis, anemias, heart lesions, diabetes, pregnancy, arteriosclerosis, amyloid degeneration, the febrile diseases, neurotic disturbances, and so on. What concerns us particularly in this connection is digestive albuminuria, and that due to kidney changes in late digestive disease.

Excessive indulgence in eggs, cheese, beef, etc., may cause an albumin output in urines. While such may be considered physiological in a sense, the fact that it is rarely observed in young healthy individuals inclines one to feel that its appearance has at least a pathological significance either in so far as the kidneys, the digestive tract, or metabolic conditions in the general body are concerned. Evidences of organic kidney change (casts, blood, epithelium), however, should always be sought for, since in many of these instances such findings are common and point to an existing nephritis. In the absence of these, a daily output of 2 grammes or over may be considered as positively pathological.

The rather constant appearance of albumin in small amounts is commonly met with in spasmed conditions of the stomach, in cancer situated anywhere in the digestive canal, following excessive gastric hemorrhage, and in atrophic conditions of the gastro-enteron (such as chronic gastritis and gastro-enteric atrophy).

Albumoses are frequently encountered in urines in a great number of acute and chronic diseases. Of the various types of albumosuria described is the form present in resorption of albumoses from the disintegration of pus cells (pyogenic albumosuria); a form found in various diseases of the intestinal tract, such as typhoid, tuberculous ulceration, carcinoma, etc. (enterogenic albumosuria); a form noted in scurvy, dermatitis, poisonings, pregnancy, particularly following death of the fetus; carcinomatosis, etc. (hematogenic albumosuria); a form wherein the albumoses are derived from urinary albumins by the action of ferments or bacteria in the bladder (renal albumosuria); and an albumosuria seen when large quantities of albumin had been ingested (digestive albumosuria). As a rule but very small quantities of albumose are met with, and unless it is isolated and examined for definitely its presence would be overlooked. The quantity is usually too small to be demonstrated by the direct application of the biuret test to the urine. Albumosuria had been met with by Robitschek in two cases out of seven cases of gastric cancer, one in gastric ulcer, and one in cancer of the rectum. At the present time a diagnostic significance cannot be assigned to the condition, and its occurrence is most probably due to an anomaly of metabolism. The albu-

moses and peptones, while different in chemical characteristics, may in this connection be considered as an expression of an identical condition.

Ferments may be demonstrated in every urine both normal and pathological. Because of the variability in which these are found, examinations for them are of no significance in diagnosis. It has been said that the normally present pepsin is absent in cases of cancer (also typhoid and nephritis), deficient in diminished gastric secretion, and increased in acute pancreatic disease. In the last, according to Hewlett's experimental work on dogs, the constant occurrence of the ferment under such circumstances might be of great importance; in these cases the examinations for the presence of the fat-splitting ferment are the most practical. Another ferment than pepsin and lipase that may be present is diastase.

The presence of glucose in urine cannot be considered of importance in the diagnosis of primary digestive diseases, and is only of interest in the metabolic conditions causing it in as these may secondarily cause digestive symptoms, which disturbances are usually of a very mild degree or absent altogether. After repeated test-meal and feces examinations in cases of diabetes mellitus with digestive symptoms it can be said that such patients but rarely manifest any decided change of digestive functions until late in the stage of the disease when the digestive secretions may run low in amounts. However, the examination of urines from all digestive cases should always include a test for glucose, since the presence of diabetes mellitus may interfere with the adoption of a diet high in carbohydrates to meet a gastric condition of low HCl secretion. When sufferers from digestive disorders present glucose in the urine, even when a chronic gastritis is present, the case is primarily one of metabolic disease, rather than one of primary disorder of the digestive tract causing such excretion of glucose—this also includes those cases in which the diabetes is most apparently due to disease of the liver, or of the pancreas. An alcoholic with disease of the liver who presents sugar in the urine should be considered as a case of hepatic disease even if the glucose is only transitory, or only found after an excessive carbohydrate diet. It is the function of the digestive canal to convert carbohydrates and resorb sugars for utilization in the body, but the fault of other organs when this is not transformed and stored in the liver as glycogen, oxidized in the muscular system and possibly also elsewhere in the body, or found as an adventitious substance in the urine in pancreatic, Basedow's disease, etc. The tests for glucose, levulose, maltose, lactose, dextrin, lipose and the pentoses, all of which may be found in

diabetic urines, will be found in works on clinical diagnosis or chemistry of the urine.

The presence of acetone and diacetic acid may be found in urines. The first may be present in normal urines in amounts between 0.008 and 0.027 gramme, and the latter always as an abnormal product. The subject of acetone in feces and in gastric contents will be found in the two foregoing chapters, and in the conditions there described in which it is present, acetone may be found in the urine also. Litten[4] was the first to describe a characteristic symptom complex designated as "coma dyspepticum," wherein, after several days of prodromal symptoms, there are found a diacetic acid urine with nausea, vomiting eructations, constipation, nervous restlessness, or prostration. I have seen two such cases, one of which also had a trace of glucose in the urine at the time and which cleared up after the attack, and the other without glucose but with albumin which also disappeared in a short time. The condition presents much mystery as to its origin, and attacks not infrequently occur one or more times at long intervals. One of my cases (the one in which albumin was also noted with the diacetic acid) became pregnant five months after her second attack. which pregnancy went on to term without a recurrence or an untoward symptom. In addition to some of the digestive diseases, diacetic acid is also found in urines in diabetes mellitus, and sometimes in the pernicious vomiting of pregnancy.

Acetone in urines is much more commonly found in the primary and secondary, acute and chronic affections of the digestive canal. Among these may particularly be mentioned gastric or gastro-enteric catarrh, atonies, intestinal occlusion, constipation, cholelithiasis, and cancer or ulcer of the stomach or intestines. Acetonuria is a symptom of importance in diabetes mellitus. It is probable that in the primary diseases of the digestive canal it is derived from the proteids ingested (thus its commonness in gastric contents in stomach cancer, when it may be present early), or as an enterogenic form possibly from large amounts of fatty acids formed in the intestines. The tests for acetone are found in Chapter VII and are applicable to urines, and that for diacetic acid which serves to best purpose is the following (Gerhardt's test):—

A few cubic centimeters of urine are extracted by acidification with sulphuric acid and extraction with ether; in the latter of which the diacetic acid present is isolated. To the ether extract, a strong solution of ferric chloride is added drop by drop, at which if diacetic acid is present, a Bordeaux red color appears, which disappears on standing for twenty-four or forty-eight hours. Other substances that

may be found in urines may give this reaction (sulphocyanides, salicylic acid, antipyrine, sodium acetate, aromatic compounds) but in these the color persists for days.

The term lipaciduria is applied to the elimination of much volatile fatty acids in the urine, which condition occurs in small amounts in normal urines. It is probably that in states of high HCl secretion and in hypermotility, where the gastric carbohydrate conversion is low or when much carbohydrate had been ingested and is fermenting in the intestinal tract, the output of volatile fatty acids is increased. Lipaciduria may also be found in gastric cancer but it is not of any special significance in that connection. For the reason that lipaciduria may be found in the two extremes of HCl secretion (high, or absent or low as in cancer), no practical value can be attached to the condition.

Oxalic acid is found in normal urines as a product derived from ingested foods and also the metabolism of the body. Under pathological conditions in the digestive canal the oxalic acid may be formed as a fermentation product from the ingested carbohydrates. The amount normally eliminated in twenty-four hours fluctuates with the amount of vegetable foods partaken, and is usually less than 10 milligrammes (Baldwin). An increased elimination is observed notably in digestive and neurasthenic conditions usually when the hydrochloric secretion is high (oxaluria). It is also observed in obesity and in stenotic conditions of the bile passages. Oxalic acid occurs in the urine as calcium oxalate which is held in solution by the diacid sodium phosphate.

For the purpose of quantitatively estimating oxalic acid in urines the use of the Dunlap-Baldwin method is advised. To this end 500 cubic centimeters of mixed urine are thymolized, acidified (if alkaline) with acetic acid, and 150 cubic centimeters of over 90 per cent. of alcohol added to precipitate the calcium oxalate. The mixture is allowed to stand for forty-eight hours, filtered (water used to aid in obtaining all of the crystals from the container), and the sediment on the filter paper thoroughly washed with hot and cold water and finally with a 1-per-cent. acetic acid. The filter is then placed in a small beaker and soaked in a small amount of dilute hydrochloric acid, and then washed with hot water until the washings no longer give an acid reaction to litmus paper. The acid solution and washings (combined) are filtered and evaporated on a water bath to about 20 cubic centimeters. This is treated with a very small amount of calcium chloride solution (to ensure the presence of an excess of calcium), the solution is neutralized with ammonia, slightly acidified with acetic

acid, and treated with strong alcohol to 50 per cent. (so that the mixture contains 50 per cent. of alcohol). After forty-eight hours, the sediment is collected in a filter (mineral ash free), and is washed with cold water and dilute acetic acid until free from chlorides. The filter and its sediment are then incinerated over a Bunsen burner, and afterward with a blow-pipe flame for a few moments. On cooling over sulphuric acid the ash is weighed; the result multiplied by 1.6 represents the amount of oxalic acid present in the volume of urine examined. The great drawback to the Dunlap-Baldwin method is the amount of laboratory work required and time it takes for the estimations. A much quicker and simpler one and one which answers sufficiently for clinical work is that employed by E. E. Smith. To this end 5 cubic centimeters of filtered urine, or the supernatant clear urine (after standing for several hours to allow sedimentation), is placed in a conical end test tube and 5 cubic centimeters of alcohol are added. These are thoroughly mixed and the tube is let stand for two hours or centrifuged at once. The oxalate sediment is then withdrawn by means of a small calibered pipette, and examined microscopically by means of a medium power. Normal urines contain none or very few crystals; a moderate increase, a noticeable number of crystals (about 20 to the field); a large increase, a great number in the field (sometimes as many as 50).

The examination of the sediment of urines possesses no special direct significance in so far as the diagnosis of primary digestive disorders are concerned, and thus will not be included.

References.

[1] Drinkler: Centralbl. f. d. Medizin. Wiss., 1890, p. 498.
[2] Henry: Archiv für Verdauungskrankheiten, Bd. 4, p. 1.
[3] Simon: Clinical Diagnosis, p. 90.
[4] Litten: Zeitschrift für klinische Medizin., 1884, Bd. 7, Supplemenath. p. 81.

CHAPTER X.

Therapeutics.

THE DIET.

It is evident that whatever the condition of illness for special dieting may be, there is one fact that must always be observed, and that is, that food enough and of a practical degree of mixture be given to properly maintain the physiological processes of life in their proper standard of efficiency. This is only possible by the supplying to the blood and tissues sufficient protein, carbohydrate, hydrocarbon, water and inorganic elements, so that the processes of activity in heat energy and organ functions can go on without the body tissues suffering materially thereby. Of course, the source of this is from the foods that we partake of, and in the construction of any dietary, whatever the local gastro-enteric condition may be, we must be careful that in them there is contained enough metabolic foundation for proper nutrition.

In this light, it is best to view the subject of dieting in a double way. Firstly, what is about the amount of foods that, digested (allowing for the inevitable loss), absorbed, and oxidized, will maintain the nitrogen and carbon equilibrium in the person; and secondly, how can we modify his character of foods to meet the abnormal conditions present in the alimentary canal and still fully maintain the first indication mentioned.

In health it is a comparatively safe rule to follow, that providing the person partakes of a varied diet of the generally accepted foods of value, his supply, in so far as their quantities and character are concerned, can await on his desires for them. Such foods should be adapted that comprise both animal and vegetable foods in quantities according to the amount of work that the individual performs. With all that has been said and written upon the errors of our present-day plan of feeding in defence or in the advocacy of unique dietary régimes (like vegetarianism or the preponderating use of animal foods), in the main the time-honored custom of a mixed diet insures the greatest amount of health and strength, although with many individuals some minor errors may exist in it. It may be said in a general way, that

calories would answer for a 140-pound individual, and on a feeding over that, at such a weight, it would be reasonable to expect a systemic improvement in nutrition, weight, and strength.

After having established a diet which is being strictly lived up to by a patient, there is one practical means of observing its success, and that is by the frequent use of the scales in the first two weeks after beginning with it. The subjective sensations of weakness, faintness, and hunger must not receive too much attention in the face of a constantly maintained or increasing weight, good quality of pulse, and general appearance of the individual. Many gastric patients habitually overfeed themselves, and when this extra amount of food has been deprived them they temporarily are affected by it. After a short time, if the conditions continue favorable, these symptoms pass away and the patient usually ceases complaining.

Because of the compensatory functions of different parts of the alimentary canal to the different foods, it is not wise or conducive to the best results to build up the diet list on the times that the various foods leave the stomach. This phase of the subject of nutrition comes properly under consideration, when, for any abnormal condition present, we must reckon on the relief of the local symptoms or condition. But when the physician's desires are mainly upon the better nutrition of the general body, it is safe to take advantage of the fact that complete digestion in the small intestine can make good any shortage of enzymotic power that may be existing in the gastric juice or saliva.

The following list of the compositions of foods and their values is compiled from Atwater and Woods, 1896, U. S. Dept. of Agriculture. Allowance is made for the products of metabolism of protein compounds which are not consumed in the body.

COMPOSITION OF FOODS.

FOOD MATERIALS	REFUSE	WATER	PROTEIN	FAT	CARBO-HY-DRATES	ASH	FOOD VALUE PER POUND
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Calories
BEEF, FRESH							
Brisket, average as purchased	14.3	40.6	12.5	31.9	.....	.7	1580
Chuck, including shoulder	19.9	54.1	15.3	9.9	.....	.8	785
Chuck, ribs	13.3	50.1	15.0	20.8	.....	.8	1155
Flank	33.8	54.4	16.7	24.3	.....	.8	1355
Loin	12.6	53.3	15.9	17.3	.....	.9	1025
Loin, boneless strip	.....	60.7	18.9	19.5	.....	.9	1175
Loin, sirloin butt	.....	50.2	15.6	24.4	.....	.8	1320
Loin, top of sirloin	33.2	40.9	12.9	42.3	.....	.7	2025
Loin, trimmings	48.8	27.9	8.2	14.7	.....	.4	775

COMPOSITION OF FOODS.—*Continued.*

FOOD MATERIALS	Refuse	Water	Protein	Fat	Carbo-hydrates	Ash	Food Value Per Pound
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Calories
BEEF, FRESH							
Navel	11.4	42.2	13.4	32.3	.....	.7	1610
Neck	28.4	46.3	13.9	10.7	.....	.7	710
Plate	16.7	46.0	12.7	43.9	.....	.7	1245
Ribs	20.2	44.9	13.6	20.6	.....	.7	1120
Rib rolls	.....	64.8	18.7	15.6	.....	.9	1005
Rib trimmings	34.1	35.7	10.5	19.2	.....	.5	1005
Ribs, cross	12.5	48.0	14.1	24.7	.....	.7	1305
Round	8.5	63.0	18.7	8.8	.....	1.0	720
Round, second cut	32.1	47.2	14.0	5.8	.....	.9	505
Rump	18.5	47.3	14.4	19.0	.....	.8	1070
Shank, fore	36.5	44.1	13.1	5.7	.....	.6	485
Shank, hind	54.8	31.3	9.2	4.3	.....	.4	355
Shoulder, clod	14.6	57.9	16.8	9.7	.....	1.0	725
Socket	35.8	36.7	10.7	16.2	.....	.6	880
Forequarter	19.8	49.3	14.1	16.1	.....	.7	940
Round, average as purchased	8.5	63.0	18.7	8.8	.....	1.0	720
Round, second cut	32.1	47.2	14.0	5.8	.....	.9	505
Rump	18.5	47.3	14.4	19.0	.....	.8	1070
Shank, fore	36.5	44.1	13.1	5.7	.....	.6	485
Shank, hind	54.8	31.3	9.2	4.3	.....	.4	355
Shoulder, clod	14.6	57.9	16.8	9.7	.....	1.0	725
Socket	35.8	36.7	10.7	16.2	.....	.6	880
Forequarter	19.8	49.3	14.1	16.1	.....	.7	940
Hindquarter	16.3	52.0	15.3	15.6	.....	.8	945
Side	18.3	50.4	14.6	16.0	.....	.7	945
Hearts	.....	62.6	16.0	20.4	.....	1.0	1160
Kidneys	.....	76.7	16.9	4.8	.4	1.2	525
Liver	.....	69.8	21.6	5.4	1.8	1.4	665
Lungs	.....	79.7	16.1	3.2	.....	1.0	435
Sweetbreads	.....	70.9	15.4	12.1	.....	1.6	795
Tongue	15.1	53.9	14.8	15.3	.....	.9	920
Beef, cooked sandwich meats	.....	58.3	37.9	11.0	.....	2.8	985
BEEF, CANNED							
Boiled	.....	51.8	24.4	22.5	.....	1.3	1405
Ox, cheek	.....	66.1	22.3	8.4	.....	3.2	707
Chili, con carne	.....	75.4	13.3	4.6	4.0	2.7	515
Collops, minced	.....	72.3	17.9	6.8	1.1	1.9	645
Corned, cooked	.....	51.2	25.9	18.9	.....	4.0	1280
Dry, cooked as purchased	.....	44.8	38.6	5.4	.....	11.2	950
Kidney, stewed	.....	71.9	18.4	5.1	2.1	2.5	595
Luncheon	.....	52.9	26.4	15.9	.....	4.8	1160
Ox palate	.....	71.4	17.4	10.0	.....	1.2	745
Roast	.....	58.9	25.0	14.8	.....	1.3	1090
Steak, rump	.....	56.3	23.5	18.7	.....	1.5	1225
Sweetbreads	.....	69.0	19.5	9.5	.....	2.0	765
Oxtails	.....	67.9	24.6	6.3	.....	1.2	725
Tongue, ground	.....	49.9	21.0	25.1	.....	4.0	1450
Tongue, whole	.....	51.3	21.5	23.2	.....	4.0	1380
Tripe	.....	74.6	16.4	8.5	.....	.5	665
BEEF, CORNED AND PICKLED							
Brisket, corned	21.4	40.0	14.7	19.4	.....	4.5	1090
Beef, corned	9.4	49.6	14.2	22.8	.....	4.0	1225
Extra mess	10.4	33.1	10.6	42.3	.....	3.6	1980
Flank, corned	12.1	43.0	12.4	29.2	.....	2.6	1465
Mess	10.5	33.0	10.7	39.9	.....	5.9	1885
Plate, corned	14.5	34.3	11.4	35.8	.....	4.0	1720
Rump, corned	6.0	54.5	14.4	22.0	.....	3.1	1195
Spiced and rolled	.....	30.0	11.8	51.4	.....	6.8	2390
Tongue, pickled	6.0	58.9	11.6	19.2	.....	4.3	1025
Tripe, pickled	.....	87.4	10.9	1.2	.3	.2	260
BEEF, DRIED, ETC.							
Dried and salted	.....	30.7	46.8	5.6	.....	16.9	1110
Dried in sun	.....	19.4	47.0	21.6	.....	12.0	1785
Dried, salted and smoked	.....	50.8	31.8	6.8	.6	10.0	890

COMPOSITION OF FOODS.—*Continued.*

FOOD MATERIALS	REFUSE	WATER	PROTEIN	FAT	CARBO-HY-DRATES	ASH	FOOD VALUE PER POUND
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Calories
VEAL, FRESH AS PURCHASED							
Breast	21.4	53.1	15.1	9.6	.....	.8	685
Chuck	18.0	59.5	15.6	5.2	.....	.8	510
Flank	.....	66.9	19.4	12.7	.....	.0	885
Leg	10.5	65.0	18.5	5.0	.....	1.0	555
Leg, cutlets	4.0	65.6	20.0	9.5	.....	.9	775
Loin	18.6	56.2	15.9	8.4	.....	.9	650
Loin, with kidney	9.1	66.7	12.8	10.7	.....	.7	680
Neck	31.5	49.9	13.3	4.6	.....	.7	440
Rib	26.4	53.0	14.8	5.0	.....	.8	485
Rump	30.2	43.7	14.0	11.3	.....	.8	735
Shank, fore	40.4	44.1	11.8	3.1	.....	.6	335
Shank, hind	61.1	28.6	7.7	2.2	.....	.4	235
Shoulder and flank	24.3	49.7	14.9	10.2	.....	.9	710
Shoulder	16.6	57.2	16.6	8.7	.....	.9	675
Forequarter	24.5	54.2	14.6	6.0	.....	.7	525
Hindquarter	20.7	56.2	15.7	6.6	.....	.8	570
Side	22.6	55.2	15.1	6.3	.....	.8	545
Heart	.....	73.3	16.2	9.6	.....	1.0	705
Kidney	.....	74.7	16.6	7.4	.....	1.3	625
Liver	.....	13.1	20.4	5.3	.....	1.2	605
Lungs	.....	76.8	17.1	5.0	.....	1.1	530
LAMB, FRESH							
Breast	19.1	45.5	15.5	19.1	.....	.8	1095
Leg, hind	13.8	50.3	15.3	19.7	.....	.9	1115
Loin, without kidney and tallow	14.8	45.3	15.1	24.1	.....	.8	1295
Neck, as purchased	17.7	46.7	14.4	20.4	.....	.8	1130
Shoulder	20.3	41.3	14.0	23.6	.....	.8	1235
Forequarter	18.8	44.7	14.7	21.0	.....	.8	1160
Hindquarter	15.7	51.3	16.0	16.1	.....	.9	975
Side, without kidney and tallow	19.3	47.0	14.2	18.7	.....	.8	1055
LAMB, CANNED							
Tongue	2.6	65.7	13.9	17.3	.....	.5	990
Ham, devilled	.....	45.3	18.9	32.9	.....	2.9	1740
Shoulder, fresh	32.5	35.9	10.4	20.7	.....	.5	1065
Shoulder, smoked	18.9	30.7	12.4	33.0	.....	5.0	1625
PORK, SALTED AND PICKLED							
Dry and salted backs	8.1	15.9	6.5	66.8	.....	2.7	2940
Dry and salted belly	8.2	16.2	6.2	66.2	.....	3.2	2910
Salt pork, lean ends	11.2	17.6	6.6	59.6	.....	5.1	2635
Tongue	3.2	56.8	17.5	19.1	.....	3.4	1130
Feet	33.5	44.6	10.0	9.3	.....	.6	580
Bacon, smoked	8.1	17.8	9.6	60.2	.....	4.3	2720
Pork, side	11.2	26.1	7.5	54.8	.....	.4	2455
PORK, CANNED							
Head	.....	60.1	17.8	19.3	.....	2.8	1145
SAUSAGE							
Arles	5.2	16.3	23.6	48.0	.....	6.9	2465
Banquet	1.6	61.7	17.7	15.4	.....	3.6	980
Bologna	3.3	55.2	18.0	19.7	.....	3.8	1165
Tongue	.....	47.6	23.6	24.0	.....	4.8	1450
PORK							
Chuck, ribs and shoulder	18.1	41.8	13.8	25.5	.....	.8	1335
Flank, cut	71.2	17.0	5.1	6.4	.....	.3	365
Head	68.4	13.7	3.8	13.9	.....	.2	655
Headcheese	12.1	42.3	18.6	24.0	.....	3.0	1360
Loin	16.0	42.3	13.5	27.5	.....	.7	1410
Middle cuts	71.2	13.8	4.2	10.6	.....	.2	525
Shoulder cuts	59.6	19.1	5.3	15.7	.....	.3	760
Tenderloin	.....	65.1	19.5	14.4	.....	1.1	970

COMPOSITION OF FOODS.—*Continued.*

FOOD MATERIALS	REFUSE	WATER	PROTEIN	FAT	CARBO-HY-DRATES	ASH	FOOD VALUE PER POUND
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Calories
PORK, HAM AND SHOULDER							
Ham, fresh	42.4	35.7	10.7	10.6	.....	.6	645
Ham, smoked	12.7	35.9	14.1	33.2	.....	4.1	1665
Boiled, no bone	.....	39.2	18.2	37.0	.....	5.6	1900
Ham, boneless, raw	.....	50.1	15.4	28.5	.....	6.0	1490
Ham, luncheon, boneless	.....	49.2	24.0	21.0	.....	5.8	1320
MUTTON, FRESH							
Chuck	19.4	37.0	11.1	31.8	.....	.7	1550
Flank	.....	42.0	13.9	43.4	.....	.7	2090
Leg, hind	17.4	52.2	15.1	14.5	.....	.8	875
Loin, without kidney and tallow	14.2	40.5	12.8	31.9	.....	.6	1585
Neck	27.2	41.0	11.7	19.4	.....	.7	1035
Shoulder	21.5	47.0	13.4	17.4	.....	.7	985
Forequarter	21.1	40.6	11.9	25.7	.....	.7	1305
Hind, without tallow and kidney	16.7	45.6	13.5	23.5	.....	.7	1245
Heart, as purchased	.....	69.5	17.0	12.6	.....	.9	845
Kidney	.....	78.7	16.8	3.2	.....	1.3	450
Liver	.....	61.2	23.1	9.0	5.0	1.7	900
Lungs	.....	75.9	20.1	2.8	.....	1.2	490
MUTTON, CANNED							
Corned	.....	45.8	27.2	22.8	.....	4.2	1470
Farmer	3.9	22.2	26.2	40.4	.....	7.3	2175
Frankfort	.....	55.5	21.7	18.8	.4	3.6	1205
Holstein	2.2	35.6	28.7	36.5	3.3	4.2	2135
Lyons	10.0	29.2	29.1	24.5	.....	7.2	1575
Pork	.....	38.7	12.8	45.4	.8	2.3	2170
Pork, sausage meat	.....	46.2	17.9	32.5	.....	3.4	1705
Summer	7.0	20.9	23.0	42.1	.....	7.0	2220
Tongue	.....	46.4	17.3	33.1	.....	3.2	1720
POULTRY AND GAME, FRESH							
Chicken	34.8	58.5	14.8	1.1	.....	.8	325
Fowl	30.1	45.6	13.4	10.2	.....	.8	680
Goose	22.2	33.1	10.3	33.8	.....	.6	1620
Turkey	22.7	42.4	15.7	18.4	.....	.8	1070
FISH							
Black bass	54.8	34.6	9.3	.8	.....	.5	205
Sea bass	56.1	34.8	8.3	.2	.....	.6	160
Striped bass	55.0	35.1	8.3	1.1	.....	.5	200
Bluefish	48.6	40.3	9.8	.6	.....	.7	205
Butterfish	42.8	40.1	10.2	6.3	.....	.6	445
Cod, dressed	29.9	58.5	10.6	.2	.....	.8	205
Eels	20.2	57.2	14.6	7.2	.....	.8	575
Flounders	57.0	35.8	6.3	.3	.....	.6	130
Haddock	51.0	40.0	8.2	.2	.....	.6	160
Halibut	17.7	61.9	15.1	4.4	.....	.9	465
Herring	62.6	41.7	10.9	3.9	.....	.9	370
Kingfish	56.6	34.4	8.1	.4	.....	.5	170
Mackerel	40.7	43.7	11.4	3.5	.....	.7	360
Perch, white	62.5	28.4	7.2	1.5	.....	.4	195
Pickerel	42.7	45.7	10.7	.3	.....	.6	210
Pompano	45.5	39.5	10.2	4.3	.....	.5	370
Porgie	60.0	29.9	7.4	2.1	.....	.6	225
Red snapper	45.3	43.7	10.0	.3	.....	.7	200
Salmon	29.5	48.1	13.5	8.1	.....	.8	590
Shad	50.1	35.2	9.2	4.8	.....	.7	375
Shad roe	.....	71.2	20.9	3.8	2.6	1.5	600
Sheepshead	56.5	31.3	8.8	2.9	.....	.5	285
Smelt	41.9	46.1	10.0	1.0	.....	1.0	230
Trout, brook	48.1	40.4	9.8	1.1	.....	.6	230
Tomcod	59.9	32.7	6.8	.2	.....	.4	135
Weakfish	51.9	38.0	8.4	1.1	.....	.6	200
Whitefish	53.5	32.5	10.3	3.0	.....	.7	325

COMPOSITION OF FOODS.—*Continued.*

FOOD MATERIALS	REFUSE	WATER	PROTEIN	FAT	CARBO-HY-DRATES	ASH	FOOD VALUE PER POUND
	Per Cent.	Per Cent	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Calories
SHELLFISH, ETC.							
Clams, round	.....	80.8	10.6	1.1	5.2	2.3	340
Crabs, hard	52.4	36.7	7.9	.9	.6	1.5	195
Lobster	61.7	30.7	5.9	.7	.2	.8	145
Mussels	46.7	44.9	4.6	.6	2.2	1.0	150
Oysters	.....	88.3	6.1	1.4	3.3	.9	235
Scallops	.....	80.3	14.8	.1	3.4	1.4	345
Eggs, hen's	.....	73.5	14.9	10.6	.....	1.0	725
DAIRY PRODUCTS, ETC.							
Butter	.....	.....	.....	82.4	.....	.....	475
Whole milk	.....	87.1	3.3	4.0	5.0	.7	325
Skim milk	.....	90.5	3.4	.3	5.1	.7	170
Buttermilk	.....	91.0	3.0	.5	4.8	.7	165
Condensed milk	.....	30.5	8.2	7.1	52.3	1.9	1425
Cream	.....	74.0	2.5	18.5	4.5	.5	910
CHEESE							
American, pale	.....	31.6	28.6	36.2	.....	3.4	2060
American, red	.....	28.6	29.6	38.3	.....	3.5	2165
Bondis	.....	55.2	15.4	21.7	.7	7.0	1215
Cheddar	.....	35.6	28.2	32.0	.....	4.2	1875
Cheshire	.....	37.1	26.9	31.6	.....	4.4	1835
Crown Brand	.....	35.2	5.2	58.0	2.2	3.2	2585
Dutch	.....	60.2	37.1	17.7	.....	10.0	1435
Brie	.....	20.7	15.9	21.0	1.4	1.5	1210
Imitation Old English	.....	42.1	30.1	52.7	1.3	5.2	2385
Limburger	.....	.....	23.0	29.4	1.4	5.1	1675
Neufchatel	.....	50.0	18.7	27.4	1.5	2.4	1530
Pineapple	.....	23.0	29.9	38.9	2.6	5.6	2245
Roquefort	.....	39.3	22.6	29.5	1.8	6.8	1700
Swiss	.....	31.4	27.6	34.9	1.3	4.8	2010
Whole milk	.....	33.7	26.0	34.2	2.3	3.8	1965
Partly skimmed	.....	38.2	25.4	29.5	3.6	33.3	1785
Skim milk	.....	45.7	31.5	16.4	2.2	4.2	1320
MISCELLANEOUS							
Gelatin	.....	13.6	84.2	.1	.....	2.1	1570
Mincemeat, commercial	.....	27.7	6.7	1.4	60.2	4.0	1305
Mincemeat, home-made	.....	56.8	4.0	6.1	31.3	1.8	915
Tallow, refined	.....	.....	.....	100.0	.....	.....	4220
Lard, refined	.....	.....	.....	100.0	.....	.....	4200
Cottolene	.....	.....	.....	100.0	.....	.....	4200
Oleomargarine	.....	9.3	1.3	82.7	.....	6.7	3515
VEGETABLE FOOD—WHEAT, FLOUR, MEALS, ETC.							
California fine flour	.....	13.8	7.9	1.4	76.4	.5	1625
Entire wheat "	.....	12.1	14.2	1.9	70.6	1.2	1660
Graham "	.....	11.8	13.7	2.2	70.3	2.0	1655
Low grade "	.....	11.4	13.9	2.6	70.8	1.3	1685
Roller process "	.....	12.5	11.3	11.1	74.6	.5	1645
Spring wheat "	.....	11.6	11.8	1.1	75.0	.5	1660
Winter wheat "	.....	12.5	10.4	1.0	75.6	.5	1640
Unclassified "	.....	12.3	10.7	1.1	75.4	.5	1650
Prepared "	.....	10.8	10.1	1.2	74.3	3.6	1620
Crushed wheat	.....	10.5	11.9	1.7	74.5	1.4	1680
Macaroni and vermicelli	.....	10.8	11.7	1.6	72.9	3.0	1640
White wheat farina	.....	9.7	11.1	1.4	77.6	.2	1710
OTHER FLOURS, MEALS, ETC.							
Barley meal	.....	11.9	10.5	2.2	72.8	2.6	1640
Barley, pearled	.....	10.8	9.3	1.0	77.6	1.3	1660
Buckwheat flour	.....	14.3	6.1	1.0	77.2	1.4	1590
Cornmeal, bolted	.....	12.9	8.9	2.2	75.1	.9	1655
" unbolted	1.5	10.2	7.3	4.1	66.7	1.2	1550
Corn, hominy	.....	11.9	8.2	.6	78.9	.4	1645
Corn, pop, popped	.....	4.3	10.7	5.0	78.7	1.3	1875

COMPOSITION OF FOODS.—*Continued.*

FOOD MATERIALS	Refuse	Water	Protein	Fat	Carbo-hydrates	Ash	Food Value Per Pound
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Calories
OTHER FLOURS, MEALS, ETC. (*continued*).							
Oatmeal	.....	7.2	15.6	7.3	68.0	1.9	1860
Oats, rolled	.....	7.2	16.9	7.2	66.8	1.9	1860
Rice	.....	12.4	7.8	.4	79.0	.4	1630
Rice, boiled	.....	52.7	5.0	.1	41.9	.3	875
Rice, flour	.....	9.1	9.1	7.4	65.9	8.5	1705
Rye meal or flour	.....	12.7	7.1	.9	78.5	.8	1630
BREAD, CRACKERS OR PASTRY							
Bread, white	.....	35.4	9.5	1.2	52.8	1.1	1205
Bread, brown	.....	40.0	5.0	2.4	50.7	1.9	1135
Corn, Johnny cake	.....	38.0	8.5	2.7	47.3	3.5	1150
Cassava	.....	10.5	9.1	.3	79.0	1.1	1650
Gluten	.....	35.7	11.1	2.4	47.6	2.2	1210
Graham	.....	32.3	8.5	1.8	55.9	1.5	1275
Rye	.....	31.8	10.1	.7	55.9	1.5	1255
Rye and wheat	.....	35.3	11.9	.3	51.5	1.0	1190
Rolls, milk	.....	26.7	8.5	9.6	54.4	.8	1575
" water	.....	32.6	9.1	3.0	54.1	1.2	1300
" wheat, white	.....	23.3	10.2	5.2	60.4	.9	1530
Biscuit	.....	22.9	9.3	13.7	52.6	1.5	1730
Buns, cinnamon	.....	23.6	9.4	7.2	59.1	.7	1570
" hot cross	.....	36.7	7.9	4.8	59.7	.9	1275
" sugar	.....	30.1	8.0	8.1	51.9	1.0	1455
Cake, baker's	.....	23.3	4.6	5.9	60.5	.7	1460
" coffee	.....	30.1	8.6	6.6	53.9	.8	1600
" cup	.....	16.3	6.6	2.5	73.8	.8	1600
" drop	.....	16.6	7.6	14.7	60.3	.8	1880
" frosted	.....	17.7	6.2	9.4	64.3	2.4	1705
" fruit	.....	16.9	6.2	10.5	64.7	1.7	1760
" gingerbread	.....	16.1	5.4	9.5	64.7	4.3	1705
" marble	.....	18.5	7.1	9.3	63.9	1.2	1715
" sponge	.....	11.6	6.5	9.6	70.3	2.2	1830
Crackers, Boston	.....	8.2	10.7	9.9	68.8	2.4	1895
" butter	.....	6.9	9.2	13.6	69.4	.9	2035
" cream or milk	.....	7.0	9.3	13.1	69.2	1.4	2010
" graham	.....	5.0	9.8	13.6	69.7	1.9	2050
" oatmeal	.....	4.9	10.4	13.7	69.6	1.4	2065
" oyster	.....	4.3	11.0	8.8	74.2	1.7	1955
" pilot bread	.....	7.9	12.4	4.4	74.2	1.1	1795
" soda	.....	8.0	10.3	9.4	70.5	1.8	1900
Doughnuts	.....	17.9	6.6	21.9	52.6	1.0	2025
Jumbles	.....	24.8	7.3	15.7	51.9	1.3	1745
Pie, apple	.....	43.2	3.3	9.8	41.7	2.0	1250
" cream	.....	29.4	6.3	8.1	54.9	1.3	1480
" lemon	.....	47.4	3.6	10.1	37.4	1.5	1190
" mince	.....	42.6	6.5	12.1	37.2	1.6	1325
" squash	.....	64.2	4.4	8.4	21.7	1.3	840
Pudding, tapioca	.....	61.8	3.6	3.7	30.0	.9	780
Wafers, vanilla	.....	5.8	6.8	15.7	71.2	.5	2115
SUGARS							
Honey, strained	.....	.....	.....	.....	75.1	.....	1395
Molasses	.....	25.7	2.7	.....	78.0	3.6	1315
Sugar, granulated	.....	.....	.....	.....	100.0	.....	1860
" maple	.....	.....	.....	.....	82.8	.....	1540
Syrup, "	.....	.....	.....	.....	70.1	.....	1305
STARCHES							
Tapioca	.....	11.6	.4	.3	87.5	.2	1650
Starch	.....	.....	.....	.....	78.0	.....	1825
VEGETABLES							
Artichokes	.....	79.5	2.6	.2	16.7	1.0	365
Asparagus	.....	94.0	1.8	.2	3.3	.7	105
Beans, dried	.....	13.2	22.3	1.8	59.1	3.6	1590
" lima	.....	11.1	15.9	1.8	67.1	4.1	1620

COMPOSITION OF FOODS.—*Continued.*

FOOD MATERIALS	REFUSE	WATER	PROTEIN	FAT	CARBO-HY-DRATES	ASH	FOOD VALUE PER POUND
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Calories
VEGETABLES (*continued*).							
Beans, green	.....	68.5	7.1	.7	22.0	1.7	570
" string	.....	87.3	2.2	.4	9.4	.7	235
Beets	20.0	70.0	1.3	.1	7.7	.9	170
Brussels sprouts	15.0	75.0	4.0	.9	3.7	1.4	180
Cabbage	15.0	76.8	1.8	.3	4.9	1.2	140
Carrots	20.0	70.5	.9	.3	7.4	.9	170
Cauliflower head	.....	90.8	1.6	.8	6.0	.8	175
Celery	.....	94.4	1.4	.1	3.0	1.1	85
Corn, green	.....	81.3	2.8	1.1	14.1	.7	360
Cucumbers	.....	96.0	.8	.2	2.5	.5	70
Eggplant	.....	92.9	1.2	.3	5.1	.5	130
Greens	.....	82.9	3.8	.9	8.8	3.5	275
Kohl-rabi	.....	92.1	2.0	.1	5.5	1.3	145
Leeks	.....	91.8	1.2	.5	5.8	.7	150
Lentils	.....	10.7	26.0	1.5	58.6	3.2	1635
Lettuce	.....	94.0	1.3	.4	3.3	1.0	105
Okra	.....	87.0	2.0	.4	9.5	.7	230
Onions	.....	87.3	1.7	.4	9.9	.7	235
Parsnips	.....	79.9	1.7	.6	16.1	1.7	355
Pease, dried	.....	10.8	24.1	1.1	61.5	2.5	1640
" green	.....	79.1	4.4	.5	16.1	.9	400
" sugar, green	.....	81.8	3.4	.4	13.7	.7	335
Potatoes, boiled	.....	73.7	2.7	.2	22.3	1.1	475
" raw	.....	78.9	2.1	.1	18.1	.9	380
" sweet	.....	69.3	1.8	.7	27.1	1.1	565
Pumpkins	.....	93.1	1.0	.1	5.2	.6	120
Radishes	.....	90.8	1.4	.1	6.6	1.1	155
Rhubarb	.....	94.4	.6	.7	3.6	.7	105
Ruta-bagas	.....	88.9	1.3	.2	8.5	1.1	190
Sauerkraut	.....	86.3	1.5	.8	4.4	7.0	145
Spinach	.....	92.4	2.1	.5	3.1	1.9	120
Squash	.....	86.5	1.6	.6	10.4	.9	245
Tomatoes	.....	94.4	.8	.4	3.9	.5	105
Turnips	.....	88.9	1.4	.2	8.7	.8	195
VEGETABLES, CANNED							
Asparagus	.....	94.4	1.5	.1	2.8	1.2	85
Beans and pork, baked	.....	68.0	6.9	3.3	19.7	2.1	665
Beans, string	.....	93.6	1.1	.1	3.9	1.3	95
" French string	.....	95.2	1.1	.1	2.5	1.1	70
" lima	.....	79.5	4.0	.3	14.6	1.6	360
" shelled	.....	72.7	7.0	.2	18.5	1.6	480
Brussels sprouts	.....	93.7	1.5	.1	3.4	1.3	95
Corn, green	.....	75.7	2.8	1.3	19.3	.8	465
Corn and tomatoes	.....	87.6	1.6	.4	9.6	.8	225
Okra	.....	94.4	.7	.1	3.6	1.2	85
Pease, green	.....	85.3	3.6	.2	9.8	1.1	255
Potatoes, sweet	.....	55.2	1.9	.4	41.4	1.1	820
Pumpkin	.....	91.6	.8	.2	6.7	.7	150
Squash	.....	87.6	.9	.5	10.5	.5	235
Tomatoes	.....	94.0	1.2	.2	4.0	.6	105
FRUIT, BERRIES, ETC., FRESH							
Apples	.....	82.0	.5	.5	16.6	.4	340
Apricots	.....	85.0	1.1	.....	13.4	.5	270
Bananas, yellow	.....	74.1	1.2	.8	22.9	1.0	480
Blackberries	.....	88.9	.9	2.1	7.5	.6	245
Cherries	.....	86.1	1.1	.8	11.4	.6	265
Citron melons, dried	.....	25.6	.4	.6	72.5	.9	1380
Cranberries	.....	88.5	.5	.7	10.1	.2	225
Figs, fresh	.....	79.1	1.5	.....	18.8	.6	380
Grapes	.....	78.8	1.3	1.7	17.7	.5	425
Lemons	.....	89.3	1.1	.9	8.3	.5	210
Muskmelons	.....	89.5	.6	.....	9.3	.6	185
Nectarines	.....	82.9	.6	.....	15.9	.6	305
Oranges	.....	88.3	.8	.6	9.7	.6	220
Pears	.....	83.9	.6	.8	14.2	.5	310

COMPOSITION OF FOODS.—*Concluded.*

FOOD MATERIALS	REFUSE	WATER	PROTEIN	FAT	CARBO-HY-DRATES	ASH	FOOD VALUE PER POUND
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Calories
FRUIT, BERRIES, ETC., FRESH (*continued*).							
Pineapples	.....	89.3	.4	.3	9.7	.3	200
Plums	.....	78.4	1.0	.....	20.1	.5	390
Prunes	.....	80.2	.8	.....	18.5	.5	360
Raspberries	.....	85.8	1.0	.....	12.6	.6	255
Strawberries	.....	90.9	1.0	.7	6.8	.6	175
Watermelons	.....	92.9	.3	.1	6.5	.2	130
Whortleberries	.....	82.4	.7	3.0	13.5	.4	390
FRUIT, DRIED							
Apples	.....	36.2	1.4	3.0	57.6	1.8	1225
Apricots	.....	32.4	2.9	.....	63.3	1.4	1230
Currants	.....	27.9	1.2	3.0	65.7	2.2	1370
Dates	.....	20.8	2.2	5.1	70.4	1.5	1565
Figs	.....	22.5	5.1	.....	70.0	2.4	1395
Grapes, ground	.....	34.8	2.9	.6	60.5	1.2	1205
Raisins	.....	14.0	2.5	4.7	74.7	4.1	1635
FRUIT, CANNED							
Apples, crab	.....	42.4	.3	2.4	54.4	.5	1120
Blackberries	.....	40.0	.8	2.1	56.4	.7	1150
Blueberries	.....	85.3	.6	.7	13.0	.4	280
Peaches	.....	93.7	.5	.2	5.3	.3	115
Pineapples	.....	61.8	.4	.7	36.4	.7	715
Chestnuts, fresh	.....	38.5	6.9	8.0	44.9	1.7	1300
Chestnuts, dried	.....	5.8	10.6	10.0	70.9	2.7	1940
Cocoanut	.....	3.5	6.3	57.4	31.5	1.3	3125
Peanuts	.....	9.2	25.8	38.6	34.4	2.0	2560
MISCELLANEOUS							
Chocolate	.....	10.3	12.5	47.1	26.8	3.3	2720
Cocoa	.....	4.6	21.6	28.9	37.7	7.2	2320

AMOUNTS AND CHARACTER OF FOODS IN DIGESTIVE DISORDERS.

In the matter of the feeding of a sick person and the construction of a diet, we must take into consideration the advancing, lowering, or maintenance of his nutrition, supplying enough calories to the body to maintain his power of energy, and at the same time change the character and amounts of foods so as to properly meet the digestive powers however disturbed they may be found. Many times, when the general body is below proper nutrition or when other definite indications exist for specific food elements, for the time being at least, it would be wisest to disregard the changed condition of gastric digestion and keep one's attention generally on the nutrition of the body as a whole. Often many of the local conditions will make substantial improvement under this application. On the other hand, it must ever be remembered, that local conditions may exist in the digestive power which absolutely disregarded will result in little or no general improvement (because the foods are not fully or are improperly digested), and that the local condition would be rendered subjectively worse with the

accumulation of undigested foods from which added general as well as local harm may result. As examples of this may be mentioned the errors of gastric and small intestine digestion causing low amounts of secretions in these organs (such as organic disease of the glandulature of the stomach, pancreas, and small intestine), where there is abundant toxogenic decomposition of the proteins and fats due to bacteria in the canal, or where the albumin loss of the whole food is constantly great. In the construction of the diet to meet abnormal conditions in the alimentary canal, the note must be sounded that should a mistake be made it might better be made on the side of too much food rather than being too strict in the curtailing of it. Attention is again drawn to the facts that the proteins may be markedly decreased and the quota of circulating proteins be maintained by the carbohydrates, and that these, under conditions of good starch digestion, can be considerably increased without the causing of local distress; and further, that the entire canal is compensatory in its digestive power to all distinct food substances.

When the gastric digestion is slow (the primary atonies, pylorospasm, hypomotility nervosa, chronic gastritis, pyloric stenosis), it is of service to select such foods as make but small demands upon the stomach and which pass out quickly. By doing this, we serve to prevent the degree of subjective distress, control the dangers of gastric fermentations, and assist generally toward better systemic nutrition. Of assistance here, is the following table, quoted from Penzoldt, of the time that definite quantities of the various foods leave the stomach in health. As all fluids pass through the stomach rather quickly they have not been included.

From one to two hours:—

100	to	200 Gm. milk, boiled.
200	Gm.	meat broth (no addition).
100	"	eggs, soft.
200	"	beer.

From two to three hours:—

200	Gm.	cocoa with milk.
200	"	light wines.
400	"	beer.
300	to	500 Gm. milk, boiled.
100	Gm.	eggs in any style.
100	"	beef sausage, raw.
250	"	calf's brain, boiled.
200	"	fish boiled.
75	"	oysters.
150	"	cauliflower, boiled.
150	"	potatoes, boiled or mashed.
70	"	light bread, fresh or stale.
50	to	70 Gm. of biscuits, zwieback or crackers.

From three to four hours:—

230 Gm. spring chicken, partridge or squab boiled.
190 " spring chicken, partridge or squab broiled.
250 " beef, raw or cooked.
160 " ham, boiled.
100 " roast veal.
100 " beefsteak, raw-scraped, chopped.
100 " roast beef.
200 " fish, boiled.
150 " breads, biscuits, cereals, vegetables, and fruits.

From four to five hours:—

210 Gm. squab, broiled.
250 " fillet beef, beefsteak, broiled.
250 " beef's tongue.
250 " ham, broiled.
250 " goose, roasted.
280 " duck, roasted.
150 " lentils, purée.
200 " pease, purée.
150 " string beans, boiled.

The above list is far short of many of the foods ordinarily used but is quite representative in class, and from these, their amounts, the estimation of total elements, and the comparison of those which are not included, fair general deductions with the others can be made to acquire knowledge of the degree of retardation. To select from a more ample list is often necessary in those who have idiosyncrasies to certain foods, or because they might favorably affect constipation, diarrhea, types of enteric disturbances, etc.

In the pyloric stenoses, a liquid or semifluid diet is essential, because of the difficulty of the more solid foods in passing through the narrowed exit. In the benign stenoses, where the gastric secretion is good, more solid foods (meats, fish, bread, purées) or those containing more protein can safely be employed. When the secretion is low or absent, the fluid diet is best, or the use of the more solid substances finely ground or powdered. To assist the emptying of the stomach in pyloric stenoses and to minimize the degree of fermentation, frequent feedings of small amounts, the rather free use of water and lying on the right side or back assists in the emptying of the stomach.

As with the pyloric stenoses, atonies, pylorospasms—where we feed fluids in frequent small quantities to meet the dynamic deficiency or embarrassment,—so also when the gastric mucosa is irritated (hyperesthesia, gastralgia, post-ulcer irritations), or when to save the degree of irritation from the presence of foods, or the dangers of prolonged gastric digestion (ulcer, erosions, gastrorrhagia), the fluid diet should be the first one installed. But in these last mentioned conditions frequent feeding should not be resorted to because these stom-

achs usually empty well, and frequent feeding adds up the sum total of irritation whether the diet be fluid or not.

Opinion is still divided on the wisest plan of diet for the cases of oversecretion of gastric juice. Where the acid is high (hyperchlorhydria, acute ulcer, gastritis acida), the opinions range from a high protein diet to bind the acid on the one hand, and a carbohydrate to eventually control its formation on the other. The question will not be definitely settled by the type of controversy that now rages, because different cases can not be figured by statistics on the simple question of acid alone. The entire subject is too complex for that. We must also take into consideration the amounts of mucus and the enzymotic power present in the gastric juice, the factor of the general condition of the system, and the facts pertaining to the healing of gastric or duodenal ulcers, etc.

Where the acid is higher than the amount of enzymes, as I have observed often in even gastritis acida, the employment of a high protein diet (meats) is worthy of attention, and is often followed with benefit to the patient. But care must be exercised that in our efforts to bind all of the extra acid we do not cause the stomach to develop more coaptation secretion of HCl and cause the condition to become substantially worse. In the working up of the diet to a safe meeting point to the acid, the heavier use of the vegetable proteins is the best to employ, although the animal proteins should form the main stay up to just short of the enzymotic content. Beyond this point the animal proteins are more irritating to these stomachs than the leguminous vegetables. But when the secretion of the stomach is low in mucus and the acid content deficient, a diet of the mixed variety, but somewhat more plentifully in the vegetable proteins, gives the best results in the long run.

With the uncomplicated hyperchlorhydrias it is of practical value to observe whether the high run of acid is due to just an acute nervous exacerbation, such as is commonly seen in the neurotics of the middle aged, or if it is a well-established high or continually running acidity. In the first, a high protein diet to bind the excess free acid for a few days answers well. But in the more chronic cases, hyperchlorhydria chronica, whether accompanied by irregular secrêtion (gastrosuccorrhea) or not, a continued high protein diet prolongs the condition. In the beginning of the treatment in these chronic cases to relieve the local distress this binding feeding is often of service. But it has been the author's observation that in the course of time the natural adaptability of the stomach works up to the excess proteins, and the tendency is for the secretion to become permanently higher. To put

these patients on a heavy vegetable diet in the beginning is also unwise, because in such a stomach the conversion of the total starches is low, even when much ptyalin had been incorporated with the food. It is best then to begin high with the proteins, and then gradually curtail their quantities and supplant the shortage with carbohydrates. It is a system of working the secretion down, and brings about the best and most prominent results. The fats are well borne in these superacidities, and act as mechanical sedatives, or inhibit the secretion of the hydrochloric acid.

In acute ulcer ventriculi, each case must be figured upon the conditions of secretion that accompany it. In most of these cases, in the young and middle aged particularly, the acidity is high, and an ulcer is too *bona fide* and serious a condition to trifle with on points of dieting. All mechanical, chemical, and thermic irritations must be rigidly excluded; so it is best to keep the diet fluid, bland, and not too hot or too cold. This is best brought about by the use of a milk and egg diet. To these later may be added the vegetables in the form of purées, but meat and other solid foods had best be left out altogether until very late in the course of the treatment.

In the cases of deficient gastric secretion (hypochlorhydria, gastritis—particularly atrophic, and achylia gastrica) it is desirable to control the amounts of total proteins, and sustain nutrition more with carbohydrates and fats. Meats should not be excluded altogether, because the intestines can take charge of them if they are properly selected and finely cut. The vegetables in soft forms and the fats in good division are well borne by these stomachs.

In the sensory disturbances of the stomach, much depends upon whether they are primary in the stomach, or secondary to general neurotic conditions. In the primary type (such as gastralgias, hyperesthesia) foods and drink, as free from thermic and mechanical irritation as possible, should be employed; usually a carefully selected soft mixed diet serves well in these cases. Where the condition is secondary (neurasthenia gastrica, crises of locomotor ataxia, reflexes from diseases of other organs) the same rule holds good in pronounced cases, although the general system must be looked upon as in a state of disturbed nutrition, and the diet soon maintained at a higher level to meet the requirement.

It is important that all foods be properly masticated before swallowing. This holds good particularly in the neurotic disturbances of the stomach. It is plain that in disturbed states of gastric secretion, large masses of food in the stomach not only increase the local distress but often lead to a serious protein loss through the bowels.

When the gastric acidity is low, even when the pro-enzymes are present in sufficient quantities, thorough chewing is of much value to add the full amylolytic power of the saliva and render the chyme finer so that it can be more readily changed by the low acid content.

Important also in the chronic gastritides, is the changing of the character of foods to meet the added catarrhal states due to the warm weather. This also holds good in the summer intestinal conditions, such as in acute and subacute intestinal diarrheas, and in the infective conditions of the gut.

In cases where vomiting, pain and immediate distress after ingestion are prominent features, changes in character, temperature, and quantities of foods become essential.

All of the subject of special dieting is entered into with more detail in connection with the treatment of the various conditions. The above is intended only as a rough general draft on the subject. It has been the author's observation that more mistakes are made in dieting gastro-enteric cases than good is done. As case after case comes to us, how often do we see patients of low nutrition, debilitated and anemic, in the production of which it is most suggestive that long processes of useless dieting have had strongly to do with the production of these general conditions, and on the other hand are seen cases in which a liberal degree of license in the selecting of foods has prevented recovery. The principles of dieting are not difficult to understand, and most persons are willing to apply and persist in preserving them, particularly when they are deriving benefit.

In the construction of a diet for a patient, we should take into consideration the general condition and the character of life that the person lives (active, physically or mentally, sedentary and so on); and secondly, the nature and extent of the abnormal gastro-enterological condition present; then the foods that should be digested with the best results; and lastly also, how and when they should best be taken. To meet these indications we have ample lists of the different foods, and their caloric values in the various quantities to select from. All diet lists should be constructed in this definite way, for it is always best to decree to the patient what foods and amounts he should partake of, rather than the uncertain place of general and indefinite direction, or of the still poorer one of the giving of a list of the "must not takes" in all cases.

SUBJECT-MATTER CONTRIBUTABLE TO DIETETICS.

Almost as many as are the number of the different races of people in this world are the character of foods that they habitually partake of. In the great civilized centers where a variety of food is readily procurable, the diet is usually a mixed one, comprising a choice of wide selection to meet the palates of differently disposed peoples. From the fat-eaters of the North, to the fruit and vegetable eaters of the torrid zones, through the meat-eating Aryan and Semitic races, scattered as they are all over the world, the fish and cereal-eating East, and those living in the rural parts of civilized countries where the character of foods partaken of awaits to a large extent on the limitations that exist locally in the kinds that are obtainable, the greatest possible differences are seen.

Long standing habits and customs of a people must be taken into consideration in the construction of dietaries, but not to the extent of the more definite indications or contra-indications present in each individual case. This is true also with the real food idiosyncrasies of particular individuals. Where these latter exist (and they are common) they should be found out and the taking of such foods should not be insisted upon, because it is usually seen that these idiosyncrasies refer to foods which, in character and desirability, are not important. The specific question, "What foods have always disagreed with you?" will generally bring forth such articles of diet as "strawberries, all berries, brussels sprouts, cabbage, turnips, pears, bananas, fish, bologna, veal, etc." On the other hand, many cases of gastric disorder will relate the names of substances, such as soups, the rough vegetables, meats in quantities, and so on, which, before their illness, they could partake of with comfort and benefit, but which now seem to intensify their suffering. The reason for most of this often becomes apparent when an accurate diagnosis of the gastric condition has been made, since they are often found to be substances that irritate the existing condition, or fall short of digestion because of secretory deficiency in the gastro-intestinal canal.

Sometimes it will be noted that when it is important to keep up the supply of certain food groups, a change in the cooking (frying and boiling, *versus* roasting and broiling), or the nature in which they are served, as when drier, more fluid, scraped or chopped, and in the quantities and intervals in which they are taken makes an important difference, and renders rather the badly borne ones possible of use. A choice variety of small quantities of those in the same group sometimes makes them acceptable and worthy of consideration. The intol-

erance of such important articles of diet and ready nutrition as eggs, milk, etc., should be looked into carefully, for these should be retained if at all possible in most cases.

Often in the stress of acute illness, patients will partake readily of fluids and have an aversion for the more solid foods. Here, such articles as milk, kephyr, buttermilk, albuminous and starchy drinks, eggs in fruit juices, reinforced meat broths, cold or warm, often permit of the giving of sufficient caloric values, and at the same time meet the lowered secretions and motility of the digestive canal. In convalescence, of course, the semisolid and solid foods are the most valuable as a basis of feeding.

The cooking of foods often changes their caloric values. It is obvious that the addition of animal fats, butter, starches and so forth, which are added to meats and fish in roasting and frying, increase the potential value of the food as a whole. The same is true with the starchy foods.

Boiling hydrates the starches and thus renders them easier of conversion. But it solidifies the protein mass in meats of older animals and that which is served too soon after killing. Boiling also deprives the foods of the incorporated fats. Boiled milk is a little slower in digestion than raw milk; this is probably due to the coagulation of the milk albumin by the heat. The boiling of vegetables and fruits has no effect upon the sugars that may be contained in them, but it generally softens the mass, and in that way assists, with the hydration of the starches, in the ease of the digestion of them. Boiling has a detrimental effect upon some foods; examples of these are salads, oysters, etc. In the oyster, for instance, a diastatic enzyme, which resides in the liver of the oyster, is destroyed by heat, and the whole mass is rendered tougher. Boiling favorably affects the protein of wheat (gluten), and renders it easier of gastric and pancreatic digestion. All styles of cooking young meat, fish, etc., soften and loosen the connective tissue and the denser structures in them, converting these into a soluble gelatin and thereby freeing the fibers for easier attack by the secretions of digestion.

The art of good cooking is a greater factor for the ill than for the well. It is one of the noble efforts of modern education of the young in our schools that they are taught the principles of proper cooking. For here they learn not only the scientific side of the art, but also to use diligence, care and cleanliness in the procedures of preparation. Second only to the added palatableness of cooked foods, is the proper seasoning of them. Many an anorexia succumbs to the subtle effects of this added zest, and few have not noticed the fact that new and

strange dishes attractively served, as they are in hotels and first-class restaurants, often induce the ingestion of more food than would be possible at home.

In the selection of foods only the best qualities should be used—for those in health as well as the ill. Care should be exercised also that during the cooking process the utensils be covered with lids. Copper vessels should always be properly tinned, and earthen or porcelain ware pots should be preferred to all others. Most cooked foods should not be permitted to stand and again served at long intervals afterward; chemical changes are liable to take place which may lead to nausea and even to their ejection from the stomach by vomiting. It is best to discard that which is not used, and keep the fresh foods on ice until utilized. Naturally all pots should be scrupulously cleaned after use. Furthermore, foods and drink should not be brought to the table too hot or too cold. The use of salt is of course essential, but the employment of too much spicing is injurious—jaded palates can be appealed to without these by simply changing the nature of foods or employing other ways of cooking them. The use of citron, pomegranate, orange or lemon skins are also injudicious. The table should be set attractively, and the use of good dishes, table plate, flowers, attractive ways of serving, etc., are worthy of consideration, for one feeds with the eyes quite as much as with the mouth. Likewise, good friends and convivial company at the table embetters the mental state and reflexly assists in good digestion. Grief robs us of our appetite and disturbs digestion.

During the first stage of active secretion of gastric juice after the meal, when the blood in large quantities is circulating within the walls of the stomach, it is best to rest or at least not engage in any active work. Care should also be taken not to bathe too soon before or after meals—one hour before and three hours afterward are safe intervals.

The feeding of those acutely ill is a matter of vital importance, for the life of a patient often depends upon the degree of nutrition that can be maintained during the acute stage, and on the recovery of strength during convalescence. When the fever is high the body is losing weight rapidly, and the products of combustion, urea, carbonic acid, and water, are excreted in larger amounts. To replace these in acute illness we are at a disadvantage, because of the anorexia, poor assimilative power, and diminution in the quantities and efficiency of saliva, gastric and pancreatic juices and bile. Likewise, the stomach is sensitive and the general nervous system quite upset. Here, of course, the fluid foods, possibly in smaller quantities, are a boon to nutrition, and in this a good nurse is essential to prepare and admin-

ister them. When on a milk diet the stools should be carefully watched for undigested curds; when these are present, peptonization or the use of diluents should be employed. Every careful observer has noticed that many patients are starved during acute illnesses. The increase in body temperatures is less responsible for the loss of weight and strength than is the patient's inability to receive and digest the foods; therefore special and carefully prepared foods should be employed. Remissions of temperature should be taken advantage of, and the patient's feeding pushed. During convalescence an artful nurse can do more with skillfully prepared and artistically served foods to restore the patient than can a physician with tonics.

ARTIFICIAL FOODS.

By the term artificial foods is meant the proprietary or patented foods that are used for the feeding of the sick or under-nourished. They comprise collectively much too wide a range of different preparations and their importance is not of enough value to enter into them in any detail. They are intended for use in those who are seriously ill and not able to partake of the more substantial regular foods; in cases of irritable stomachs, vomiting, etc.; as a way of giving proteins, carbohydrates, and fats in a more readily digested and assimilated form, such as in cases of lowered gastric digestion; and as a supplemental feeding in the under-nourished.

In the peptone or, better, the albumose preparations, the proteins of various kinds (casein, beef, etc.) have been acted upon artificially by the enzymes pepsin, papain, pancreatin, bromalin-pineapple and the use of superheated steam. Among most prominent of these may be mentioned Mosquera's Beef Powder, Sanatogen, Tropon, Somatose, Mulford's Predigested Beef, Liquidi Peptonoids (a complex mixture), Leube-Rosenthal's Meat Solution, and Valentine's Meat Juice. Of these Sanatogen and Tropon contain the largest percentage of albumin among the powders. Most of the liquid preparations contain alcohol in varying amounts, some of them as high as 30 per cent. It is obvious that the presence of alcohol in these large quantities vastly increases the caloric values of the preparations, but this increase is brought about in a most undesirable way and should not be employed in reckoning the value of the preparations as nutriments. If any are used it is best to employ the powder forms, because they contain a known quantity of albumose, and thus can be computed in a more positive way than the liquid varieties.

The carbohydrate preparations are mostly flour, starch, or sugar

preparations, some containing soluble leguminose. Others again are milk powders in varying amounts. Some fat preparations have been introduced but other than the oil and egg emulsions they have met with only scant attention.

Taking them all together as a class, it may be said that they are but poor substitutes for foods themselves. The time will never come when *multum im parvo* feeding will sustain a human being in health, or even be a food substitute for nourishing the sick. Their use is a starvation diet at the best. At the present time enough attention to the details of dietetics is not given in our medical schools, and a lack of knowledge has permitted the medical profession to place too much reliance upon these medicinal food substitutes.

The Council of Pharmacy and Chemistry of the American Medical Association have done praiseworthy work in investigating the nutritive value of a number of these predigested foods, and the results, as published in *The Journal of the American Medical Association,* May 11, 1907, are worthy of delineation:—

"In order to get a fair conception of the actual value of these various preparations, it is desirable to make some comparison which can be readily understood by every physician. The amount of good milk necessary each twenty-four hours to sustain the vitality of a patient during a serious illness is not less than 64 ounces, or approximately 2000 cubic centimeters. The food value in calories represented in this amount of good milk may be placed at 1430 calories. This includes not only the proteid and carbohydrate matter, but the fat as well. By comparing this available potential energy with the total energy in the predigested foods under consideration, it can be readily seen that if a physician depends upon the representations made by some of the manufacturers and feeds his patient accordingly, he is resorting to a starvation diet. The largest number of available calories, including alcohol, present in any of the recommended daily doses, is less than one-fifth of the number of calories represented by 2000 cubic centimeters of milk; and the calories represented by the daily dose of the preparation poorest in food products is only one twenty-fifth of the amount present in 2000 cubic centimeters of milk. These figures tell their own story. Making 2000 cubic centimeters of milk the basis of calculation, and estimating the amount of the various preparations required to yield this number of calories, it is found that the quantity to be administered daily to supply 1430 calories, including alcohol, varies from 716.2 to 1506.2 cubic centimeters. In other words, it will be necessary, in order to supply 1430 units of energy per diem, to administer the amount of the various products in quantities found

[illegible] in many cases the amount of alcohol ex- [illegible] would keep the patient in an alcoholic [illegible] necessary to supply this energy varies [illegible] these prices with the two quarts of milk. [illegible]

[illegible] in the past many patients have suffered [illegible] preparations have been used to sustain life. The [illegible] easily remembered and spoken, falls far short [illegible] recommendation for their use in maintaining nutrition. [illegible] reason they are so well borne by a disordered [illegible] the regular foods are not, is because they have [illegible] them that they demand but little tax on the [illegible] This fact holds good in their use in the chronic [illegible] stagnation, ulcer, carcinoma, etc. A small place [illegible] their use as supplemental foods but not as the founda- [illegible] or they may be used in a makeshift way as a very [illegible] cases of very irritable stomachs, vomiting, hemorrhage, [illegible] a space of feeding for a few days and still satisfy the [illegible] relatives or friends about the patient.

[illegible] home preparations can be made by a nurse that serves as [illegible] most times better in all cases. Among these a few may be [illegible] noted: —

Milk, peptonized or plain.
Milk, modified with water, barley water, vichy, seltzer, etc.
Junket and whey.
Kumyss, matzoon, buttermilk (plain or modified).
Nutritious beef, mutton and chicken broths.
Beef juice.
Albuminous, starchy and chocolate drinks.
Thin soups of various kinds.
Gruels (reinforced or plain).

NUTRIENT ENEMATA.

It has been shown conclusively that, even without previous peptonization, proteids may be absorbed in small quantities from the lower bowel. The same is true with emulsified fat, saccharified starch, the sugars themselves, and the inorganic salts and water. The addition of sodium chloride, particularly in the case of egg albumin, enhances the absorbability of the proteins, and when these elements have been previously peptonized, and thus more or less converted into the albumoses or peptones, the facility and amounts that are taken up by the rectal and colonic mucous membrane are favorably influenced.

The nutritive enemata, however, are but a poor second in their

results to stomach route of feedings, and even in a case of the greatest care of preparing the bowel for the reception of the food, carefully selecting them, using only small quantities and peptonizing the foods, and the marshalling of all of the skill that a careful nurse can exercise in the work, failure is common. To present the various deductions as to whether only peptones should be used, and how much of the food elements are actually absorbed, etc., helps but little in this subject. The fact is, that in actual practice patients are met with in whom rectal feeding meets with scant success or downright failure from the very beginning or in a short time after its institution—to patients of all degrees of tolerable success up to its being a practical method of great value. When a patient is met with in whom rectal feeding is indicated it is always an uncertain and anxiously awaited problem as to of what value these may be. There seems to be a different inherent power in different persons to the value of this procedure. The author has seen cases in which, where with the exercise of the greatest care, so little food was absorbed or the gut became so quickly intolerant that it was of no practical value or had to be discontinued. In others, again, it may be kept up with satisfying success for days—one of my cases for over nine weeks. In addition to perfect technique, much depends upon an existing healthy condition of the lower gut, and the demands of the system for nutrition.

When foods are constantly being vomited from the stomach; or when because of stenotic conditions in the cardia or esophagus they cannot reach that organ; when it is advisable to allow the stomach to rest from secretion, motility, or irritability, or when we wish to add foods to the body extra to what may be put into the stomach, such as in pyloric stenosis or subnutrition, the rectal route of feeding may have to be resorted to. But once beginning with it, great care should be exercised that the technique be as perfect as possible, lest the gut becomes intolerant and the patient be deprived of its use altogether. So much practical benefit can be derived from its use in late gastric carcinomas, gastric hemorrhage, recurrent gastric ulcers, gastralgias, uncontrollable vomiting, intense hyperesthesia of the stomach, etc., that the author feels constrained to give some consideration to the details of technique, compositions of the most practical enemas, etc.

It is important to deliver the nutritive enema in a sigmoid and rectum that is empty of scybalous masses. For this reason it is best to first give a cleansing enema of normal salt solution (about 250 cubic centimeters), and wait until this has been returned. The salt solution not only evacuates the lower bowel of feces, mucus, etc., but it has a beneficial effect upon the mucosa, serving to preserve this in health

for a longer time than would be the case if it had not been used or only plain water employed. It may further be stated that the previous use of the salt water enema enhances the absorption of the feeding following it.

The best tube to use is one sufficiently stiff so as not to coil and of about 1.5 centimeters in diameter. Remembering that the absorptive power from the rectum is the least of the entire intestine, it is important to deliver the food as high as possible—at least 25 centimeters from the anus. If the food is delivered too low down, it is liable to be quickly expelled, and if it be retained for lengths of time, much of the enema may lie unabsorbed, decomposes, and thus eventually irritates the mucosa of the rectum. It is best to lubricate the tube well with sweet almond oil, and introduce it slowly with a twisting movement, upward and backward. With care and skill, the end of the tube can always be placed within the sigmoid, and under favorable conditions into the descending colon. Naturally the higher it is introduced the better will be the results obtained, and in cases in which the procedure is to be kept up it has been the author's custom to use a length of tubing and deliver the meal at the point of the gastric flexure of the colon, or into its transverse portion, a not difficult matter when the tube is sufficiently stiff, or favoring positions of the body are employed.

An important recent contribution on this by Soper detailing X-ray observations of the position of tubes properly passed argues against the possibility of entering the sigmoid or colon, and that only the dome of the rectum is reached, the remainder of the tube coiling upon itself in the rectum. In further favor of the antiperistalsis carrying foods from this point upward is the fact that by the use of a bismuth suspension injected into the rectum with a short tube in a few moments the bismuth would have traveled upward making possible a good picture of the colon. However, the sigmoid may be slightly bent or absent, or the tip may be flooded into the sigmoid by manipulation and allowing the fluid to run in while introduction is taking place and thus a high instillation be possible.

To be successful, the enema should never be given in the sitting or dorsal position of the patient. Very ill patients should be placed on their left side and a hard cushion be used under the right buttock so as to have the sigmoid at a lower level than the anus. When patients are well enough to be moved about, this position can be made extreme, or better the knee-chest position employed.

The introduction of the feeding is performed either with a syringe attached to the tube, or by having a length of tubing outside of the

patient so that fluids poured into a glass funnel on the end of it can be raised high enough for gravity to force it to flow from the other end into the bowel. The enema having been thoroughly mixed and strained through a piece of cheesecloth if there are any particles in it is held in a pitcher from which it is poured very gently and slowly into the funnel. This is then elevated so that its contents can trickle through the tube. In this way no air is introduced. With the funnel still raised the tube is then withdrawn, and the patient made to remain quiet for about twenty minutes. If properly given, it is rarely necessary to use the folded towel to make pressure on the anus to hold back the enema.

It has been the author's custom, to seldom employ more than 150 cubic centimeters of fluid, and to give the enemas from four to six times in the twenty-four hours. Under favorable conditions a greater quantity can be used, but it is best not to administer the feeding at shorter intervals than four hours.

The foods given in this way should be bland and unirritating, as condensed as possible, and given at the temperature of the blood. The addition of salt to the food aids materially in the absorption, and is particularly of service when eggs are used. Brandy and whiskey are sometimes of service in the food as a stimulant, but as a general practice they are best omitted since alcohol is too irritating. All the enemas, especially those containing milk, should be peptonized. It has been my custom to peptonize even the single egg and meat juice enemas. A good essence of pepsin is handy in accomplishing this, better in my opinion for enemas than the use of the dry forms of pepsin. This essence adds just enough alcohol to assist in the absorption of the peptones or proteoses. Should the rectal mucosa become irritated, the addition of from five to ten drops of laudanum to the mixture is of service.

A great variety of formulas have been advanced for use. Some of them are too low in caloric value, and others again are too bulky to be safe for continued use in the average case. Among those that I employ and recommend are the following:—

I.	White of two eggs	30.2
	Peptonized milk (warm process) ..... 90 c.c or ℥iij	60.0
	Caloric value	90.2
II.	Warm milk ..... 130 c.c. or ℥ivss	87.
	Yellow of one egg	61.
	Sanotogen ..... 2 Gm. or gr. xxx	6.4
	Grape-sugar ..... 2 Gm. or gr. xxx	7.4
	Table salt ..... 1 Gm. or gr. xv	0.
	Caloric value	161.8

Whole peptonized for ten minutes with 2 c.c. of essence of pepsin.

III. One whole egg			76.1
Table salt	1 Gm. or	gr. xv	0.
Red wine or brandy	12 c.c. or	ʒiiiss	28.
Peptonized milk (warm process)	90 c.c. or	℥iij	60.
		Caloric value	164.1

In suitable cases the above amounts can be increased or the formulas modified:—

Boas' formula:—

Milk	250 grammes.
Yolks of two eggs.	
Table salt	3 grammes.
Red wine, one tablespoonful.	
Wheat starch, one teaspoonful.	

Ewald's formula:—

Wheat flour	40 grammes.
Water or milk (lukewarm)	150 grammes.
Eggs, one or two.	
Table salt	3 grammes.
Grape-sugar sol. (15 per cent.) 50 to 100 c.c.	
Red wine about 60 c.c.	
Nutritive value about 450 calories.	

Because of the more thorough conversion it is best to employ the warm process in the peptonization of milk. Milk, whey, beef juice, peptones, and egg-solutions alone make very excellent nutritive enemata, and serve well as changes from the heavier combinations. When the enemas are kept up for a length of time it is often wise to change their character from time to time. This often obviates the danger of establishing irritation in the rectum or colon.

Of late, considerable doubt has been thrown about the nutritive efficacy of rectal feedings. According to the observations of Edsall and Miller to determine how much actual nutriment the body absorbed from the bowel, it is claimed that most of the solids remain unabsorbed, and only the saline and water constituents of the injection were utilized. Boyd and Robertson concluded as a result of experiments that the most that can be absorbed amounts to from 240 to 645 calories, about one-quarter of the amount of nourishment required to maintain nutrition. These observations, in the author's opinion, are important in the way that they serve to show the futility of the still common practice of giving nutritive enemata too low in the bowel and also the use of those which are too bulky. Efforts should be made to reach as high in the colon as possible, and it is not impossible (and if carefully performed without danger to the patient) to have the meals reach the transverse and even into the right side of the colon, where, of course, the nearer to the ileocecal valve it would reach (assisted by posture), the better would be its absorption.

Unless patients are in an extreme condition, the enema properly given and retained can be relied upon to sustain a practical degree of nutrition for a number of days and sometimes weeks. Improvement in weight, however, in many cases is due also to the absorption of water from the meal. It is true that enemata equal to 2000 calories per day are too bulky and uncertain. I believe that under favorable conditions about 1200 calories are about all that can be expected to be utilized. In light-weight patients constantly in bed, this would be almost sufficient to sustain metabolism without depriving the tissue body and fluids to a great extent. But even should this amount of calories fall short of the individual person, still it is a practical saving as compared to the total loss from starvation when the fluids (salines) are used for enemata instead of them.

It is important to remember, as pointed out by Umber and observed on several occasions by myself, that a nutritive enema reflexly stimulates gastric secretion to about one-half of the amount that would be observed by the same food in the stomach. When the necessity for food is keen and the body sensitive to nervous action, I have observed on two occasions that the entire gastro-intestinal canal slowly moved in peristaltic movement after a nutritive enema. One was a case of gastrorrhagia due to late hepatic cirrhosis, and the other recurrent hemorrhages due to an acute gastric ulcer. In the latter case, the movements persisted for about an hour after each injection, when they gradually subsided. The increase in secretion and motility are two points easy to be controlled by the use of alkalies (mineral) given in solution by mouth and atropine sulphate hypodermically before each enema.

OTHER METHODS OF FEEDING.

Subcutaneous Nutrition.—As strange as it may seem to state it—because there is no actual nutritive present—a most serviceable as well as simple measure administered by the skin route is the use of the saline infusion. By this method, it is only possible to supply the necessary quota of fluids to the body, and we must depend upon the tissues of the body to supply the material for metabolism for the time being, a not altogether dangerous thing to do in extreme cases of gastric hemorrhage, when for any reason it is not practical or may be thought unwise to employ rectal feedings.

Peptones and albumoses when introduced under the skin are not absorbed and produce toxic effects in addition. The carbohydrates (sugars) are but difficultly absorbed, and the pain caused by them and

the small amounts which are taken up make their utilization of no practical value. The fats, as v. Leube[2] has shown, are taken up in quantities of from 50 to 100 grammes at a time. The fat should be in the form of a bland oil, which had been sterilized, and allowed to run under the skin by the funnel and long tube method using a long trocar, or, better still, pressed under the skin by means of a special apparatus. It is a painful procedure although in my experience not so much so as in the case of the sugar solution. It may, however, be worthy of a trial for a short time in extreme cases.

It may be said in conclusion that, taking it all in all, as good if not better results can be obtained by the use of the simple saline solutions alone as by any other combinations, and on these that it is sometimes surprising how well sustained many persons will remain for a few days if they are given no foods in any form, providing they are supplied with sufficient water for the time being.

Gavage.—Occasionally in the insane, or possibly in extreme states of anorexia, it would be necessary or advisable to resort to this method of feeding. In infants, particularly those which have been intubated for stenotic laryngeal affections, gavage becomes a necessity, and here the common and most successful practice is by passing the catheter downward through the nose, rather than through the mouth. In these instances, the tip of the tube runs along the floor of the nasal fossa and, striking the pharynx, bends downward in back of the soft palate and onward into the esophagus and stomach.

Gavage is the method of choice in the feeding of the unconscious. In these patients the procedure is not difficult to carry out, although sometimes it is necessary to exert quite a steady pressure on the tube's entrance into the esophagus before it will pass. Care must be taken with these patients, before the food is run down through the tube, that the end is surely in the stomach or gullet, and not in the respiratory canal. With a tube such as the commonly used (Ewald) passed through the larynx, the end hole will permit, in all unconscious persons, of breathing through the apparatus without much evident distress. Before the meal is run down, it is advisable first to put the ear to the funnel and listen for respiratory sounds; with the tube in the proper place naturally these would not be heard.

The method is often of service to take advantage of an anorexia in undernourished patients in which regular lavage is being carried on. I confess to being guilty of the institution of a mock form of lavage in a case of a petulant young woman who, because of a long standing neurasthenia and somewhat irritated stomach, partook of only the most meagre amounts of food during the day. The pint of

milk with two eggs she artificially received twice a day following the washings of her stomach did much to restore her to health again.

Nutrition Through Fistula.—This form of nutrition comes under consideration when the entrance to the stomach has been permanently occluded (benign or malignant stenoses of the pharynx, esophagus or cardia) in cases where, as a result of surgical operation, a permanent opening is made into the stomach for the purpose of passing foods directly into that organ; or when the stomach has been rendered useless by extensive carcinomatous growth in the body of the organ, and in gastric incapacity following the taking of corrosive poisons; where nutrition may be kept up through a jejunal fistula made according to the Mayo operation.

In the malignant cases, of course, the method is resorted to also for the purpose of prolonging life. When the route to the stomach is clear, or the body of that organ is not involved by disease, the establishment of a gastric fistula should not be resorted to in preference to the much better results obtained from the gastro-enterostomies. But when, on the other hand, the entrance to that organ is impractical for the passage of foods, and the stenosis is not malignant (cicatricial contraction of the esophagus), the method is one of great value.

The foods which are passed into such fistula should be fluid or semisolid, and properly warmed. Care must be taken that the temperature of them is not too high, and it is best to regularly employ a thermometer for this purpose. The meals should be given finely subdivided, and too much carbohydrate is liable to cause excessive gastric fermentation. It is not necessary to peptonize any of the foods, and patients should lie down when these meals are being administered. The author has a patient, a man weighing 182 pounds, who, as a result of a complete cicatricial stenosis of the esophagus following the drinking of a quantity of strong lye solution which he mistook for milk, has been feeding himself in this way most satisfactorily for over eight years.

Dietetic Cures in Gastric Diseases.—There are certain undeniable facts connected with the structure of the human body and the customs of centuries in which man has lived which answer well the one-sided teachings of any special cure advocate. In his make-up of anatomy and physiology, man may be said to occupy a middle ground between the carbohydrate-eating herbivora and the meat or fish protein-eating carnivora. In this middle ground a debate has waged for years in which the glycogen and fat of the meat foods are not fully considered by the meat-eaters who advocate the taking of albumin, fibrin and myosin; and the egg albumin, legumin, casein and gluten of the

vegetables given their fair position of grace with the vegetarian. The truth of the matter is, Nature has provided man with few foods that are not more or less compound mixtures of all of the food elements, namely, protein, carbohydrates, fat, inorganic salts and water, and it constituted and permitted man to safely accustom himself by life, environments and necessities so that wherever and however he may live, foods are at hand which will amply supply him with sustenance. Then there is the adaptability of man who changes an older habit to any new one in the way of feeding. With him the new is provided for by an ever elastic physiology however in selecting he may decree for himself, providing always that he partakes of enough proper foods, and imbibes enough oxygen and water to maintain the vital equilibrium of life.

Milk is the example of an ideal food. It contains in happy combination casein and albumin (proteids), lactose sugar (carbohydrate), butter (fat), the inorganic salts, and water. Being a fluid it is quickly delivered into the stomach, which it leaves rapidly, after which all of its constituents are entirely absorbed and utilized by the economy. In every way it is a sovereign nutriment for the sick.

In digestive disorders its employment is of service in many ways, but just because of this it is the height of empiricism to warrant that it be worthy of a too general attention in the therapeutic way and thus establish it as a cure for all digestive disorders (milk cure). When taken even in large quantities (3 liters a day), most healthy individuals cannot be perfectly sustained by it, simply because it does not meet the nitrogen equilibrium and does not carry enough carbohydrate and fats to support full nutrition and metabolism. I have also observed that total milk feeding is an anemia-producing diet.

Whenever we wish to avoid the irritation of foods on the gastric mucosa (ulcer of the stomach and duodenum, the irritative neuroses, etc.) the full employment of milk is most useful. Its fluid nature makes it of great service in the stenoses of the pylorus, and in many of the conditions of intestinal origin. Its blandness and high proteid composition make it of value where the HCl content of the gastric juice is high, and when we wish to (so-called) "bind the acid" and therefore save the stomach from the irritation of an excessive free acidity. It is of great service as a nutriment for the very ill, and as a supplemental food taken between meals and before bedtime for the tubercular, neurasthenic, undernourished, poorly developed, etc.

In the catarrhs of the stomach where gastric secretion is low or the mucous production is much increased, excessive milk feeding is not well borne and may do actual harm. This is also true of the cases of

primary gastric atonies, wherein the weight of it drags the lower part of the stomach down still further, and often its fermentation causes an added distention of the organ—two particularly bad features in gastric myasthenias. In diarrheal conditions, most of which are no doubt bacterial, milk might serve as a culture media for the organisms and prolong such conditions; this is also true in many of the flatulent disorders of the enteron. Many gastro-intestinal cases are also accompanied by a constipation, which condition is made worse by systematic milk feeding. When a diarrhea results from its use, it is probably bacterial in its origin, and its use should be discontinued at once rather than changing the form in which the milk is taken. In conclusion, it may be stated that there are persons who report that milk is very badly borne. It should always be found out definitely where exclusive milk feeding is indicated, that this is a *bona fide* condition and not just an assumption on the part of the patient from an aversion to it.

In those very few instances of intolerance to milk, its modification by certain admixtures, such as barley, lime, or arrac water, plain water, Vichy or seltzer, or even the addition of a little alcohol or brandy, frequently effects better conditions for digestion. Peptonization of the milk is, however, the best course to pursue when it is not well digested.

A most useful preparation of milk is fresh cream which contains from 8 to 20 per cent. of fat. This can be added to whole milk to increase its caloric value, or taken plain diluted with water, Vichy, seltzer, etc. Cream itself makes an excellent supplemental food, and I have seen stomachs which would tolerate this and would reject plain milk.

Of value indeed, are the fermented milks, kephyr, kumiss, matzoon and buttermilk. In the acute and subacute gastric conditions, particularly those that are secondary to other illnesses, these are most valuable. The fermented milks are often of more service than peptonized cow's milk, and in cases in which vomiting is a prominent symptom I have observed that they can exert a sedative action on the stomach. In the paretic and atonic conditions of the stomach the use of buttermilk or plain milk which had been acted upon by the lactic acid bacillus (Lactone Tablets[3]) is of service. This is due to the stimulating effects of the lactic and butyric acid present in the milks, and upon peristalsis. Boas[4] reports satisfactory results from the use of one, two and three days' kephyr in constipation, intestinal atony, and habitual diarrhea.

The ordinary order of vegetarian diet is worthy of recognition in

the treatment of digestive disorders. In its strictest sense (exclusive of milk, cream, butter, cheese, eggs, etc. (animal products), and depending upon the carbohydrates alone, it should never be utilized, because really it is a diet of abstinence, much too bulky, and contains too much indigestible wood substance (cellulose) for safe or comfortable digestion. It may be said that the best form of vegetable diet is a heavy combination of vegetable carbohydrates and proteins to which the bland but highly nourishing animal food derivatives have been added. Only this combination is considered in the following lines. The ideal diet is a combined one of the lowest amount of animal protein and animal fats, to which the work and fuel supplying carbohydrates of the vegetables have been added in sufficient amounts to protect them. The carbohydrates, as has been mentioned before, are the great protein sparers. Further than this, the nature and chemical character of vegetable foods can be taken advantage of to meet certain indications that may be present in gastro-intestinal disorders (dynamic forms of constipation).

Care must be exercised that when a bland or fluid diet (milk, cream, eggs, liquid albuminoids, etc.) is being used, in the course of time, we guard against the development of states of relaxation or atonies which they encourage to develop by the low degree of peristalsis that is required for their digestion. At these times the vegetables, fruits, and less so the meats, are of signal value. Also, the more thorough digestion and absorption of a high protein diet leaves but a small amount of residue in the colon, and constipation, particularly when the bland foods are being used, becomes a troublesome feature in most of the cases—here again the use of the vegetable foods, because of their mechanical stimulation and the bulkiness they give to the feces is of value. The use of the carbohydrates is of excellent service in cases of low or absent secretions of gastric juice where such are not due to malignant disease (subacid and atrophic gastritis). The less the specific secretion, the better they are borne by the stomach. But when there is peristaltic shortage accompanying any of the gastric affections, or when, on the other hand, a hypermotility exists, care must be exercised that the irritation of a bulky and more or less indigestible vegetable diet does not cause more relaxation in the first instance, or an aggravation of the condition in the second. In sensitive stomachs, such as is present in the irritative neuroses, gastralgia, hyperchlorhydria; those that are mechanically embarrassed (pyloric kinking due to gastroptosis); sometimes in neurasthenia gastrica, and of course in ulcers, the use of the rougher vegetables (cabbage, brussels sprouts, kohl rabi, beets, seeds and skins of fruits, etc.) are wise

to withhold from the diet whatever accompanying conditions there are present which might indicate their use.

The rest cure, and particularly the feed and rest cure, occupies a minor yet important place in the treatment of digestive disorders. These, like all other routine therapeutic agencies, are of service in indicated cases, and are injudicious to inaugurate on a patient who does not definitely belong to that class. Practically, it may be said, that they are of benefit in the hysterical conditions, less so in the neurasthenic, and of harm in the hypochondriacal. They are of the most value in the low constitutional conditions of a nutritional nature wherein the digestive disturbance is secondary rather than primary in nature. Here, the rest permits of an adding to the loss of energy, and a high feeding, of from 3 to 4 thousand caloric units, builds up the nutrition of the system. In the neurasthenias in which the manifestations are markedly of an irritative or psychical nature, the rest and isolation are valuable measures in the control of the neurotic condition, both systemic and gastro-enterological. In the neurasthenias or pseudo-neurasthenias of strictly gastro-enteric origin, the poorest results are obtained by these methods of treatment, and it is the author's observation that it is best not to advise their use. Likewise, in the neurotic cases caused by the chronic gastritides the results are poorer than when patients are handled in the up and routine of life way—by regulation of habits and hygiene, attention to diet, rest, exercise, medicinal and mechanical treatments, tonics, hydrotherapeutic measures, etc. Whenever true organic affection of the stomach exists (ectasia, myasthenia, gastritis) one should hesitate to institute a "rest and feed" cure, because it may be found that the results are not only poor, but ofttimes when kept up for weeks at a time positively harmful. Sometimes, however, even in these cases where we wish to control very prominent neurotic symptoms and closely observe a patient for a week or two, a modified form of the cure is of value.

The complete cure should take from four to five weeks, and the length of time should be definitely stated to the patient and relatives in advance, and then sternly carried out when the course has once been instituted. Too large a quantity of milk during the course is not essential, and may even be most harmful (atony, increase of catarrhal symptoms, constipation, etc.). The feeding should be quite general, and rather heavy in quantities of cream, carbohydrates and fats. Regular general massage is of value from a nutritional standpoint, for the passive exercises make good the absence of the active; it also assists in the better distribution of the fats. Electricity is not of any value excepting in a suggestive way on impressionable patients. Baths

are most valuable; the cold douches or cold salt rub mornings are invigorating and stimulating, and the hot spinal douches are quite sedative (insomnia). The enforced rest and rigid quiet may be kept up to a certain time each day (say 1 o'clock), and then the patient be permitted a release of an hour or two from his thraldom, during which he can walk out, engage in a few mild matters, such as gentle conversation with a friend, reading, etc., but not in any games of competition or matters of business.

The number of instances of gastro-intestinal conditions in which the thoroughly carried out rest cure would be advisable are very few; but in what may be considered the modified form, very many. Accepting the stern principles as standards in the first instance, modification can be made in these to meet many of the indications in neurotic digestive cases and the results be perfectly satisfactory. To best describe this, it may be said that the same principles in shorter form are instituted in people who are up and engaged during the day. A close study of the individual case and the individual himself is at first essential. Then, observing the indications, we find out accurately what, in the mode and habits of his life, militate against these, and institute a change of them along the rest-cure lines. This naturally opens up too ample a field to enter into in minute detail, and since these neurotic cases differ so much, the author will depend upon the judgment of the physician who can easily and properly meet them. A few of these may be mentioned.

Patients can be made to take more rest nights—say retire at 8 P. M. and arise at 8 A. M.—that gives twelve full hours, and even if they are not asleep all of the time, by remaining in bed they are resting away from the excitement and the strength-robbing effects of active life. The hours of business and work can be materially curtailed, and the hours of pleasure and diversion increased or cut out all together as may be indicated. A change of home to some suburban district where the noises are fewer and the atmosphere of better quality than in the city may be wise. The keeping open of sleeping-room windows during the night, and the institution of invigorating or sedative baths are easily carried out. Exercise conducted regularly mornings, and walking and playing mildly-contested and non-exhausting games (as golf) are health-giving diversions to many of these neurotic cases. A diet can be followed that is constructive to the body and non-irritating to the stomach. It is important to be definite in substances, amounts, and the times of the day they should be taken. When the body becomes stronger the abnormal condition of the digestive tract also improves, this in turn means better digestion in the manner of absorp-

tion and assimilation. With the full amount of oxygen inhaled, metabolism and general body-construction are improved, and this again reacts to the benefit of the digestive canal, and thus a beneficial circle is set up. During the working hours, supplemental meals of a fluid, highly nutritional, and bland nature (milk, crackers, eggs, cocoa, farinaceous foods) can be taken; these are best taken between the regular meals. The non-irritating tonics can be used, and so on through other medication and hygienic matters as are found indicated in the case. Plainly, such a better course of life can be kept up for months, and the results in the end be quite as good as those following the rigid rest cure for a short time.

It is interesting to note that the noblest exponent and perfector of the so-called rest cure should have been an American (Weir Mitchell). For in this country surely, particularly with many of our women patients, it came as a worthy medical legacy and a benediction. But in this same land where hysterical progression, stern competition, and excessive work have made such vast progress, are found many individuals who cannot keep from, would not lessen, and who should not resort to these nerve-racking forces, and in these, as well as in those who suffer from neurotic and asthenic digestive disorders, the simpler cure, along the same lines, has, from a clinical standpoint, a place in medicine for all days to come. It is particularly appropriate to the man of business interests that require his daily observation. The taking of a rest cure in a sanatorium or the going away into the country for weeks at a time is an impossible thing for him in the activity of a business season. Then again, should he have taken our advice and fulfilled the requirements of a rest cure or a sojourn away from business, he usually reverts again into the activities that have assailed his health before. For him, as well as for those not ill enough to demand such radical measures in the first instance, the modified form above suggested is most valuable.

References.

[1] Boyd and Robertson: Scottish Medical and Surgical Journal, March, 1906.
[2] V. Leube: Verdaundlungen des 13 Krongresses für innere Medicin, 1905.
[3] Parke Davis & Co., Detroit, Michigan.
[4] Boas: "Diseases of the Stomach," p. 310.

CHAPTER XI.

Medicinal Treatments.

THE ACIDS.

In deficiency or absence of the normal HCl secretion in the stomach, acids are used to render a medium favorable in reaction for the activation of the pro-enzymes that are secreted; if possible to regulate the pyloric reflex and cause stimulation of the duodenal mucosa for a higher status of intestinal digestion; to act as a local stimulant and tonic to the stomach in the way of exciting a greater amount of HCl secretion; to act as an antiseptic, and for diagnostic means.

In a deficit of HCl, rationally, one would want to supply acid in amounts and at such times after meals as would be necessary to acidify the chyme to the ends of gastric digestion, which, of course would be variable in each case according as the gastric analysis displays information of the diminution of the secretion. Considering that an Ewald test-meal removed in the height of its digestion (60 minutes) showed a moderate decrease of secretion (subacidity), less quantities of the acid should be employed than in anachlorhydria, and its administration should not be made until the stomach had had time to secrete its own quantity of acid first. Then again, should larger amounts of food than is present in the Ewald meal have been ingested, and particularly when such meals are more highly albuminoid and mixed in character, it makes a difference in the quantity and interval after meals in which it is taken. These remarks pertain to individuals who are suffering from digestive disorder, and not those who have had a deficiency or absence of HCl secretion for years without any symptoms.

As to the benefits which come from the administration of the acids to assist gastric digestion and the doses in which they should be taken there is a wide variety of opinions on the part of various observers. Schüle[1] claimed that the use of hydrochloric acid showed no influence at all even in large doses, and Boas[2] practically agrees with him and says that it is far more likely that the acid exerts an influence on the motility of the organ and in this way benefits digestion. While, in the author's observations, the administration of hydro-

chloric acid does act as a motor stimulant to the stomach and assists in the emptying of the organ during digestion, I cannot agree that its use in suitable instances is without chemical benefit in the digestive way. The crux of the question in cases of subchloryhdria or anachlorhydria is: Are pro-enzymes present in the gastric juice of the individual or not, and if they are present, is there sufficient acid secretion to activate the ferment quantity regularly secreted or not? A low or absent HCl content in test-meals is no more an indication for the administration of acids than is that of any cloud in the sky of rain. To administer acids to a case which has an achylic condition in so far as all of the digestive secretions are concerned is manifestly short-sighted medicine, and the same is true when only small quantities of the proferments are present and there is normally enough acid to activate them. The subject has to do mainly with the pathology of the enzymotic gland cells and the state of the secreting mechanism of the organ. In cancer, for instance, the acid secretion is usually the first to go, and for a short time in its early decline the administration of the acids can give some benefit in the case. But when, as commonly occurs, the combined acid-enzymotic secretion becomes absent, then the giving of the acids is of no value and often causes intense subjective distress; the same is true in atrophic gastritis, and those rare and of short duration cases of achylia due to neurotic disturbance in the secreting function of the organ (achylia is here used as referring to an absence of all stomach secretions, excepting mucus, which is the proper designation of the term, and not simply to an anachlorhydria). In most of the cases of simple chronic gastritis where the proferments are present, the acids are of immense benefit in the assisting of digestion and the relief of subjective symptoms, and often in the stimulation of a higher normal HCl secretion, and as a stomach tonic. In late cases when little pro-enzymes are formed it is of no value, particularly when much mucus is present in the organ; in these instances its use, especially in large doses, acts as an irritant to the organ and therefore should not be given. In selected cases of the depressed forms of secretory neurosis when pro-enzymes are present, it is capable of much benefit both in the immediate chemical and motor way and relief of symptoms, and also as a local stimulant to normal secretion of gastric juice and thus indirectly as a general tonic to the body.

As to the dose to employ, Riegel[3] was correct in determining this according to the individual case. In some instances very small doses taken late after eating suffices, and in others, Ewald's[4] advice of large doses (90 to 100 drops) may be necessary. Care must be taken, how-

ever, not to give more acid than would just be necessary for full saturation, and it must be remembered that, when administered under proper conditions, the stomachic effects from the acid are not due to the effects of the free acid itself on the mucosa directly stimulating more secretion, but indirectly to the tonic effects on the entire stomach as an organ from the better status of digestion taking place in it. For the purpose, the pure hydrochloric acid (31.9 per cent. absolute HCl), or acidum hydrochloricum dilutum (10 per cent. absolute HCl), well diluted, are the best forms to employ. My individual preference is for the diluted acid because of the mitigation of the caustic effect in handling, and also to prevent the fears that the fuming acid often excites in nervous and apprehensive individuals. When the digestive action of the acid is desired 8 to 15 drops of the pure acid or 25 to 50 drops of the dilute acid are dissolved in a tumbler of water, and taken at 15-minute or ½-hour intervals after meals, using about one-quarter of the quantity at a time, and continuing until the glass is empty. The freshly made nitrohydrochloric acid, or the dilute form, may be used instead, and is the better preparation to employ in the chronic forms of gastritis of alcoholics when the stomachic effects of the acid are desired. On these occasions it is best to employ the acid before meals, and to combine it with one of the bitters, such as the following:—

℞ Acidi nitrohydrochloricum dil.	6.5
Syrupi aurantii	40.0
Tinct. gentianæ comp.	20.0
Aquæ	q. s. 100.0

Fiat et Sig.: Take one tablespoonful three times daily before meals in half a glass of water.

The nitrohydrochloric acid for practical purposes can be made by adding 1 part of nitric acid to 4 parts of hydrochloric acid, and the dilute form is approximately a 10 per cent. absolute acid. In order to protect the teeth and obviate the disagreeable sensation in the mouth, these acids should be taken through a glass tube and the mouth well rinsed with an alkaline solution afterward, or the teeth cleaned with a little bicarbonate of soda on a tooth brush.

The question as to whether the administration of hydrochloric acid alone can bring back the normal acid secretion has been answered differently. From Jaworski, who claims that the gastric secretion of acid is lowered by prolonged administration, through L. Wolff, who noted no change in the chemistry after a week's administration, to Riegel, Reichman, Mintz, and others, who could demonstrate free HCl in stomachs in cases in which no secretion existed before its employment, is a wide variety of opinions. My belief is from many observations on the subject the acid has been too loosely administered in

the way of carefully selected cases and according to the existing pathology in each. Hydrochloric acid can work up a higher status of HCl secretion when organic or malignant change has not also robbed the individual of the pro-enzyme secretion; this can easily be proven by its employment in many of the neurotic conditions of a depressed nature even when an anachlorhydria has existed for a length of time. But, as a rule, its administration in dose and time must be carefully regulated to each case, and care must also be taken not to discontinue its use too soon or keep it up too long—these can be judged by frequent test-meal analyses in each instance. The acids are occasionally employed as an antiseptic in the stomach. For this purpose they may be taken at any time in reference to meals, on an empty stomach, between meals, or nights and mornings. My preference in those low secretion cases with bacterial increase is to give it in the usual way after meals on the practical observation that I have seen the doses to be more efficacious in the desired way at these times. For these cases, the giving of the acids is only a poor substitute for regular lavage, particularly when this is done with a weak HCl solution. A solution of the acid sometimes answers to good purpose in making a diagnosis of gastric ulcer of the acute type. There are cases of such in which the symptoms are only suggestive and in which the cardinal symptoms of pain, excessive vomiting, hematemesis, etc., are absent or present only in a very modified form. In a few of these, the giving of say 50 drops of the dilute acid in a half a tumbler of water on an empty stomach will occasionally excite a boring pain in the stomach, nausea, vomiting, etc., by its irritating chemical effect on the ulcer surface.

The contra-indications to the use of hydrochloric acid are, of course, states of high secretion, hypermotility, hyperesthesia, and gastralgia, and the irritative organic states of the stomach. With the employment, care should be used in cases of apparent subacidity when a hyperesthesia exists, because, as Riegel has pointed out, and which is dealt with more fully elsewhere in this volume, these may be instances of an excess secretion for that stomach in the first instance, even if the acid secretion be low in a small quantity of the filtrate.

ALKALIES.

Since the days of Claude Bernard who found that small doses of the alkalies have a stimulating effect on the gastric secretion and the taking of large quantities neutralized the acidity of the gastric juice in animals, the alkalies have been largely employed in the treatment of digestive disorders. In suitable cases it can definitely be said that

their use comprises the most valuable medicament we have in the relief of subjective symptoms in the majority of cases of gastric disorders that come to the clinician, and the reason for this is that states of high secretion make up the majority of the functional, neurotic, and mildly organic disorders that are encountered.

More extensively than in connection with the acids, the controversy has waged for years as to the value of the alkalies in the way of stimulating a higher HCl secretion, all authorities having agreed as to its neutralizing effect in excess secretion. In my opinion, the alkalies taken before meals are of no practical value in stimulating a higher secretion. The benefits in this way in cases of chronic gastritis (in which the HCl is usually lowered) reported from Carlsbad, Vichy, Vals and other springs, is not due to direct specific medical virtue in the waters but to the regular routine of living, freedom from depressing business and domestic worries, fresh air, good sleep, abstinence from alcohol, the dissolving effects of the alkaline waters on the adherent gastric mucus, and purgative effects from the sulphate salts. It is probably, as Hemmeter[5] has suggested, that the taking of an alkali before meals could act as an irritant to the mucosa and set up a secretory reaction in about the same manner as a saline solution to the nasal mucosa would excite a mucus flow. But this is not always the case in the stomach, and not at all so unless the gastric mucosa and the secreting apparatus are normal.

In hyperchlorhydria and hyperchylia, the alkalies are given after meals at the time when the symptoms of irritation from the free acid manifest themselves (pain, distress, pyrosis, distention of the stomach, eructations, etc.), and in such quantities as is necessary to control the symptoms. Their employment may be kept up for long periods of time without danger to the stomach, although care must be taken when the commonly employed bicarbonate or dried carbonate of soda are used that, from the generation of large amounts of CO_2, a myasthenia or atony from distention does not develop, or that the "bicarbonate of soda habit" is not contracted in which often viciously large doses are habitually partaken of. In gastrosuccorrhea it may be taken between meals although the use of the alkaline milk or egg albumin is decidedly the best practice to relieve the distress; the same may be said of cases late in the treatment of acute gastric ulcer, in which the HCl continues excessive. Altogether, it must be said that the use of the alkalies, as well as the acids, are only temporary measures, and that the institution of more rational means for the permanent relief of these secretory states are by far the best medicine (lavage, dieting, hygiene, better mode of life, etc.).

Of the alkalies employed there are those in substance and the alkaline waters from various springs. The first comprise those in combination with carbonic acid and vegetable acids (sodium carbonate, bicarbonate, and citrate), and those combined with the earthy alkalies (magnesia usta, magnesium ammonio-phosphate and bismuth subcarbonate). Of the most valuable of these in relative value of neutralization they are in the order here presented, magnesium usta (calcined magnesia), magnesium ammonio-phosphate, sodium bicarbonate, sodium carbonate exsic., and bismuth subcarbonate; the latter possessing the additional value of being a mechanical sedative and about three times as valuable an antacid as the subnitrate salt.

Belladonna, and its most active alkaloid atropine, are also most valuable antacids in the indirect way of inhibiting the secretion of the stomach, and are most valuable additions to the alkalies in very high hyperchlorhydria and gastrosuccorrhea. The formulas I have found most useful in my practice are the following:—

In hyperchlorhydria (digestive increase of acid):—

℞ Magnesia usta,
Sodæ carbonate exsic.,
Bismuthi subcarbonate,
Sacchari lactis .....āā 15.0 ʒiv

Fiat et Sig.: Take one-half a teaspoonful in water, one hour after meals.

Or,

℞ Magnesia usta ..... 10.0 ʒiiss
Bismuthi subnitrate ..... 20.0 ʒv
Syrupi acacia,
Aquæ destillata .....āā q. s. ad 200.0 ℥viij

Fiat et Sig.: Take one tablespoonful, one-half, one or two hours after meals (as the case may require).

Or, when constipation exists,

℞ Magnesia usta ..... 10.0 ʒiiss
Mistura rhei et sodæ ..... 200.0 ℥vij

Fiat et Sig.: Take one tablespoonful immediately, one-half or one hour after meals as the case may require (extract of cascara sagrada may be added to the above and the dose of mist. rhei et sodæ lowered to a dessertspoonful).

Or, when a mixture of powder is not handy,

℞ Magnesia usta,
Bismuth subcarbonate,
Pulv. rhei, ...āā 25.0 ʒvj

Fiat tablets no. 1.

Sig.: Take one or two tablets one-half, one or two hours after meals as the case may require.

In gastrosuccorrhea (continuous secretion of acid),

℞ Extract belladonna ..... 0.3 gr. v
Bismuthi subcarbonate ..... 15.0 ʒiv

Fiat tablets or powders no. xx.

Sig.: Take one before meals and one of the antacid above after meals.

Or,

℞ Ext. belladonna ..... 0.2 gr. iij
Sodæ carbonate exsic. ..... 4.0 ʒj
Magnesia usta,
Bismuthi bicarbonate .....āā 15.0 ʒiv

M. et Sig.: Take one teaspoonful one-half hour after meals (0.1 of strychnia sulphate may be added to the above in cases of atony).

The Carlsbad salts, or spring waters having like chemical compositions, form most valuable adjuncts to the treatment of these conditions. According to Professor E. Ludwig, the composition of the pulverized Sprudel salts is the following:—

Sodium sulphate	41.62	per cent
Potassium sulphate	3.31	" "
Sodium bicarbonate	36.11	" "
Sodium chloride	18.19	" "
Lithium carbonate	0.2	" "
Sodium borate	0.03	" "
Water	0.44	" "

An artificial Carlsbad salt (sal carolinum fractitium), made after the German Pharmacopeia, and supplied in both dry amorphous and crystalline forms, has essentially the same chemical composition in the way of the most active salts. This contains in 100 parts:—

Sodium sulphate	44	parts.
Potassium sulphate	2	"
Sodium chloride	18	"
Sodium bicarbonate	36	"

After an extensive experience with both the imported and artificial variety, I must say that medicinally the original salt possesses no advantage over the other, so that of late, because of the cheapness and more universal procurability of the artificial salts, these are now almost exclusively used by me. Occasionally the borate and lithium salts in the Sprudel salts make their choice of some additional value.

These salts can be administered in various ways, but best not after meals—because of the purgative action of the high sodium sulphate content, and the fact that as a distinct antacid the plain alkalies are the more desirable to employ. The instances in which they are most valuable are those combining constipation with the excess acid secretion (most commonly observed), and these are met with in excess secre-

tion of the hyperchlorhydric and hyperchylic types, and in gastric ulcer. In my opinion, the best results are observed when from 4 to 10 grammes are taken, well diluted (tumblerful) in cold water, mornings on an empty stomach. This acts as a neutralizer to such gastric secretion as had accumulated in the empty stomach, a discutient to the mucus that is present and washing it into the intestine, and, after absorption into the general circulation and elimination by the lower portion of the colon, as a gentle, painless, quick, and short-acting purge. In this combined way decided benefit comes from its employment, particularly inasmuch as the salt is so well borne by the stomach that its use can be continued over a considerable length of time. This latter fact has several times been drawn to my attention in cases of gastric ulcer in which Rochelle, Epsom, and other salts had been used for their purgative action, and which salts administered on the empty stomach, immediately set up violent pains in the organ, and sometimes vomiting and hematemesis. In gastritis acida I have occasionally found for a short time some benefit in giving about 1 gramme of the Carlsbad salts just fifteen minutes before meals. As a menstruum for the salts good drinking water or plain spring water may be used, or Vichy, Fachinger, Apollinaris, Saratoga alkaline, or Bedford spring water employed. Lastly, these salts, as well as bicarbonate of soda or lime water, may be used to good purpose in weak solutions in warm water for lavaging the stomach.

OILS.

Of late years the employment of oils in the local treatment of gastric disorders has received considerable attention. This is mostly due to the experiments of Cowie and Munson[6] on human beings, and the view of Pawlow[7] based upon animals, all agreeing that the influence of oils and fats decreases gastric acidity. A difference of opinion seems to exist between observers as to how this is brought about, Pawlow believing that the effect is exercised through reflex central stimulation of the inhibitory centers of these nerves, and that the mechanical action of the oil is very subordinate. On the other hand, Cowie and Munson believe that the effect is mostly local acting in two ways—by covering and by coating the mucosa—in these ways keeping the food from direct contact with the mucosa and thus limiting the stimulating effect and causing a lower secretion of acid. To this latter view I also agree, although it must not be forgotten that in many of the excess secretions of a neurotic, and even of a catarrhal nature, well digested oil is a powerful reconstructor, energizer, and

tissue sparer, and by its constitutional effects could assist in bringing about a more normal condition of secretion in the stomach. It is common clinical observation in many of these cases that when the oil is taken before meals on an empty stomach a much more marked subjective benefit is brought about than is noted when it is taken after (in fact in most cases when so taken no benefit and even distress may be caused). The reason for the latter is that olive or cotton-seed oil, taken at any time in reference to meals, retards the evacuation of foods from the organ, and thus its employment in atonic conditions of the organ is contraindicated. This rule, however, does not hold so true when such fats as butter or its suspended form in cream are employed, since these are usually taken in smaller amounts and are better borne (although even with these, particularly in cases of fat intolerance, distress may ensue).

In hypermotility and pyloric spasms the use of the oils before meals is rationally indicated. Particularly in pyloric spasm of instances in which the cause is unknown, or in the post-operative cases whether there is much dilatation of the stomach or not, the installation of about 100 grammes of warmed oil or 50 grammes of fresh butter in the empty stomach mornings, and more or less taken during the day may give most striking benefit both in the local relief of the subject symptoms and also in the general status of nutrition. The effect upon constipation in poorly nourished neurotic persons with high secretion produced by the free use of oil is often most valuable.

In a certain class of cases for which it is difficult to ascribe reasons there is an intolerance of fats in any form. Whether this is due to poor fat digestion and absorption, a difficulty to assimilate fats after absorption—and thus of metabolic nature—it is impossible with our present-day knowledge to say. But it is certainly true that with some patients in whom their use seems to be indicated, such foods rich in fats as milk, cream, butter, eggs, olive oil, and the like, cannot be taken without discomfort. Leaving out of consideration such conditions in which the use of fat would not be advisable (icterus, pancreatic disease, structural disease of the intestinal wall, some cases of diabetes, or phthisis), as Edsall[8] has drawn attention to and also in my own opinion, enough consideration has not been paid to this subject. In a number of cases that have been referred to me in whom these foods had been used with increasing distress to the patient, the giving of fat free foods (skimmed milk, white of eggs, carbohydrates, green vegetables, etc.) has relieved the symptoms, regulated the bowels when a diarrhea existed, or controlled the constipation when the feces were hard and dry from condensation of calcium soap.

LOCAL AND GENERAL TONICS.

Of service in the treatment of stomach conditions is the use of local tonic measures. Among these, in suitable cases is the employment of lavage, proper dieting both to meet the chemico-dynamic condition of the organ and sometimes also in the effort to "work down" or "work up" the stomach functions, intragastric faradism, and lastly, the use of drugs for the same purpose, of which nux vomica and its alkaloid combinations of strychnia are by far the most active.

The very general use of nux vomica preparations in the treatment of gastric disorders has, even in the days of more empirical medicine, established this drug as of value. In the class of such useful remedies as opium, digitalis, quinina, etc., the use of nux vomica has received a very general consideration as well as broad application. The main physiological action of the active principle of nux vomica is to increase the activity and power of the non-striated as well as the striated muscular fibers (thus its value in atonic states of the gastro-enteron, heart, arteries, etc.), as well as its stimulating effects on depressed states of the central nervous system. Although its physiological effect in the dynamic and general stimulating ways is its main action in the therapeutic way, it has in addition the power to raise the gastric secretion to a limited extent. Whether this is due to just the better motility and correction of the secreting apparatus from central stimulation it is impossible for me to say, but there is no doubt of some degree of power in this direction particularly if the patient has appreciated the bitter taste of the drug when taking it; such as in the form of tincture of nux vomica or strychnine in solution (here, like all bitters, it probably reflexly stimulates gastric secretion by its peculiar persistent bitter taste).

In simple cases, such as after an attack of acute gastritis, mild neurotic conditions of a depressed nature, or in the waning digestive power of the aged, its dose need not be large, 5 to 10 drops of tincture of nux vomica, or 1 to 2 milligrammes ($\frac{1}{60}$ to $\frac{1}{30}$ grain) of sulphate or nitrate of strychnia. But in atonic conditions of the stomach, or low secretory states, such as are present in chronic gastritis, larger-sized doses should be employed. It is well, however, since one cannot foretell what the patient's tolerance will be, to start the doses at a low level and gradually increase the quantity. In marked cases of atony when the drug is well tolerated, I am not averse to giving as much as 20 or 30 drops of the tincture, or 4 or 8 milligrammes of the soluble strychnia salt in water before meals. When the taste is complained of (some people like it) the tincture may be placed in soft elastic

capsules, or strychnine employed, mixed with lactose sugar and placed in cachets, or in tablet or pill form. These high doses may be continued for a length of time, but at the first suggestion of twitching or rigidity of the muscles the dose should be lowered or stopped for the time being.

Physostigmine salicylate (eserine salicylate) or physostigmine sulphate (eserine sulphate) may be mentioned in this connection as being used in gastric dilatation mostly in those acute cases that follow surgical operations. In a close study of the literature pertaining to the use of eserine in these cases, and considering the well-known properties of this drug, I fail to understand the rationale in the use of eserine for these conditions. The single fact that the Calabar bean or its preparations produce muscular tremors by an effect upon the muscles themselves and also a raise in the arterial pressure, are but poor reasons for its employment when the well-known depressing effects of the drug are taken into consideration. Practically all of the successfully treated cases that have been reported in which this drug had been used, were also treated by posture and lavage at the same time, and, in my opinion, the benefits from the treatment were due entirely to the latter, the case recovering in spite of the eserine. Strychnine is by far the safer and more efficient drug to employ, especially when one considers that our knowledge of the causative factors at work in these surgical dilatations are still so little known. The drug is usually employed hypodermically, employing about 0.00065 gramme, or $\frac{1}{100}$ of a grain, at a time.

It may finally be mentioned that the best local tonic measures in stomach conditions are proper dieting, systematic lavage when the muscular walls of the organ are not much weakened, proper hygiene, general tonics, and electricity.

The general tonics that are so often employed in digestive cases are those that pertain to the broad field of medical conditions in which such measures may be indicated. Among a few of the medicaments and the preparations of them that deserve special mention and which receive by me more numerous applications are the strict hematinic tonics (iron, manganese), and the accessory substances that are usually added to them, such as strychnine, quinine, bichloride of mercury, etc., and lastly those medicaments that are classed as alteratives, such as arsenic, the iodides, etc. In the consideration of these, the [illegible] will be rather generally clinical in his remarks and somewhat [illegible] to their use in digestive conditions.

[illegible] accompaniment of digestive disturbances is an [illegible] states all the way from a slight and severe type

of secondary anemia to the more complex and pernicious form. Consequently it is that the use of one of the iron preparations is often called for in the treatment, and in the selection of the preparation a few words would not be amiss. Upon the degree of anemia, depends the selection of the iron preparation, the proteid combinations (albuminate, peptonate, and the proprietary forms), the organic acid combinations (ferric citrate, or the soluble form ferri et ammonii citrat in vinum ferri), or the non-astringent forms (saccharated carbonate, used in Vallet's mass, Blaud's pills, or Griffith's mixture, ferri et ammonii or potassii tartrate, or the reduced iron) being desirable for the slight and moderate degrees of anemia, and some of these (such as Blaud's pills and their combination with other tonics in elixir forms), and the astringent varieties (tinct. ferri chloridi, ferri sulphate) in the severe grades. Mixtures which have served me well in my practice are the following:—

In the neuroses, with anemia and constipation.

℞ Tinctura rhei,
Tinctura valerianæ .....āā 10.0 ʒiiss
Liq. ferri peptonati cum mangano ..... 100.0 ℥iiiss
Fiat et Sig.: Take one (or two teaspoonfuls) after meals in water.

Or,

℞ Sodæ bromidum,
Fldext. cascara sagrada .....āā 10.0 ʒiiss
Liq. ferri albuminatum ..... 100.0 ℥iiiss
Fiat et Sig.: Take one or two teaspoonfuls after meals in water.

Without constipation, the rhei or cascara can be left out, and the bromide and valerian combined in the one mixture.

In myasthenia or atony with anemia the following is useful:—

℞ Tinctura nucis vomicæ ..... 12.0 ʒiij
Liq. ferri albuminati .....q. s. 150.0 ℥v
Fiat et Sig.: Take two teaspoonfuls after meals in water.

Strychnine sulphate may be used instead, and in weak heart action the nitrate salt is the preferable. Strychnine is an excellent corrective of acute digestive disorders in the aged. The albuminate of iron solution contains nearly 0.7 per cent. of metallic iron with 20 per cent. (vol.) alcohol, and the solution of peptonate of iron with manganese with about 25 per cent. (vol.) alcohol.

Of the dry forms of iron to be recommended for simple anemias are the following combinations:—

In the neuroses with anemia.

℞ Zinci valerianæ ..... 5.0 ʒiss
Ferri reducti ..... 4.0 ʒj
Fiat pil., tablets or capsules no. l.
Sig.: Take one after meals.

Or in the depressed conditions with anemia, the desirable nascent form of Blaud pill may be given as:—

℞ Strychnia sulphatis ..... 0.07 gr. j
Ferri sulphatis ..... 4.0 ʒj
Kalii carbonatis ..... 8.0 ʒij
Fiat capsulæ or soft pills no. xxx.
Sig.: Take one, one-half or one hour after meals, tea never being drunk with the meal before taking.

In constipation, laxatives such as ext. cascara sagrada, aloin, etc., may be added to either one of the above two combinations, but it is always best to use these separately in some form before retiring, or in cases of high acidities, the Carlsbad salts mornings before breakfast.

The following is an excellent formula in cases of persistent anorexia and anemia from whatever cause, and particularly in that of subacute or chronic gastritis:—

℞ Tinct. nucis vomicæ ..... 9.0 ʒiiss
Elixir tinct. ferri chloridi et gentianæ..... 90.0 ℥iij
Fiat et Sig.: Take one teaspoonful in water before meals.

In the average case (when non-malarial) quinine, unless used in very small sized doses, had best be left out of the combinations employed; the same may be said of the arsenic preparations, excepting possibly in the very severe grades of anemia where their short use may be of value, and also bichloride of mercury in non-syphilitic cases. The iodides and the syrup of hydriotic acid are of much value in syphilitic conditions affecting the gastro-enteron (which are usually late manifestations), and as an internal discutient and alterative in the aged. For the latter, in cases of general and also arterial sclerosis of the upper splanchnic area, the iodide preparations are always worthy of a trial. Their doses should be small in size (0.3, or 5 grains), taken in milk or water at meals, and continued for a length of time. It has been my observation, that what cannot be accomplished in the general way by these small doses could not by larger ones, and then the chemical damage to the stomach from the medicaments is always a negative factor. Mainly for this reason in these cases, I most often employ the syrup of hydriodic acid taken well diluted before meals, and to which a small amount of strychnine may often be added with advantage.

SEDATIVES.

Because of the many neurotic conditions of the stomach both primary and secondary in nature, what may be termed as nerve sedatives are often of service in the relief of the subjective symptoms. In hypermotility and spasmed states of the organ itself or the orifices, as well as in the irritative conditions (high acid secretions, sensory disturbances such as neurasthenia gastrica, hyperesthesia, gastralgia), these often serve most valuably in the symptomatic treatment. The drugs which answer to the best practical purpose in these instances are the bromides and preparations of valerian.

Of these, particularly in the more generally neurological conditions, the bromides are often most efficient relievers of symptoms of distress in the stomach. For this purpose it is sufficient and desirable to employ them after meals, and in such doses as may be necessary for the case. This latter, in my opinion, is very much a matter of personal equation in each individual, some persons receiving the desired benefits from 0.3 to 0.6 (5 to 10 grains) of the bromide of soda or potassium at a dose, others again requiring as much as 1.6 (25 grains) or more at a dose and the administration continued for some time before results are noted.

While it is desirable with these, as with all other medicaments, to stop their administration as soon as possible, and employ more intelligent medicinal means to arrive at results when possible along the more hygienic lines, still, the bromides (and also valerian) may be continued in moderate doses for a length of time without danger to the stomach. Thus it is that their doses should be lowered as the case improves, remembering all the time that in the case of the bromides the physiological action is essentially depressing in nature.

Valerian is a gentle stimulant, with an especial direction to the nervous system, but without any narcotic effects. It has been used empirically for many years in the treatment of functional nervous disorders, especially in such as hysteria, hypochondriasis, and neuralgia sometimes with benefit, sometimes not. In neurasthenic conditions affecting mainly the gastro-enteric canal its employment is well worthy of a trial, particularly when used in combinations with strychnia, zinc, or iron. There being no objection to its use (excepting the unpleasant smell), and, even in large doses no untoward effect on the stomach, the various preparations may be added to such other formulas as are employed, some of which (with the bromides) are found included in the general tonics. A few others which have at times served me well are the following:—

In clean-cut neurotic conditions, where the gastric functions seem to be normal.

℞ Natrii bromidum ..... 8.0 ʒij (or more)
Aquæ menthæ piperitæ ..... 60.0 ℥ij
Fiat et Sig.: Take a teaspoonful after meals in water.

Or,

℞ Natrii bromidum,
Tinctura valerianatum .....āā 10.0 ʒiiss
Aquæ ..... 100.0 ℥iiiss
Fiat et Sig.: Take a teaspoonful after meals in water.

Or, when anemia is present,

℞ Quinina valerianate,
Ferri valerianate,
Zinci valerianate .....āā 2.0 ʒss
Fiat capsuli, pills or coated tablets, no. xxx.
Sig.: Take one after meals.

Or, when constipation exists,

℞ Tinctura rhei,
Tinctura valerianatum .....āā 10.0 ʒiiss
Fiat et Sig.: Take 20 drops after meals in water.

Belladonna, and its most active alkaloid atropine, may be mentioned in this connection as a sedative to employ in cases of excess secretion. While the unpleasant effects from its use (dryness of the throat, thirst, eye symptoms, hot skin, etc.) are a deterrent to its general employment, it nevertheless comprises, in my belief, the most valuable medicament we have for these conditions. It may be considered as a practical fact, that a digestive hyperchlorhydria, a persistent hyperchlorhydria, and a gastrosuccorrhea are simply grades or degrees of states of excess secretion, and that any medicament which, by its physical action, can control the output of gastric juice in this way would be a rational remedy to employ. This is well borne out in the handling of these cases, and, in the author's belief, this medicament has not received the broad application its use deserves in the treatment of these common gastric conditions. Here, again, it may be argued that belladonna is only temporary in its effects and does not possess the properties of a cure. I myself consider that such measures as proper dieting, regular living, freedom from mental strain, sojourn in the country, etc., give by far the more permanent results; still, there is a fact, not mentioned elsewhere to my knowledge, that a stomach condition which has once worked up a high secretion of whatever degree and then treated under conditions of life in which this was developed does not respond as quickly, or continue as permanently

in the lower secretion when treated by dieting and the alkalies alone, as it does when belladonna (atropine) has also been employed. It is a clinical observation of mine that an amount of HCl beyond the saturation of food present in the stomach can, by virtue of its chemical irritation, cause still greater gastric juice secretion, and for this reason alone the drug is most valuable. In hypermotility and spasmed states of the organ it often serves to good purpose by its antispasmodic properties, and since these conditions are commonly present with excess secretion and also in many acute ulcers it is doubly useful. In acute gastric ulcer it serves to excellent purpose to hold down the coaptation HCl from the Lenhartz proteid fluid diet and its use protects the gastric mucosa during the course of repair. In the treatment of the average case of digestive hyperchlorhydria it is but rarely necessary, proper dieting and the alkalies answering well enough. In persistent hyperchlorhydria and gastrosuccorrhea it is best given about half an hour before meals, and in some cases of gastrosuccorrhea (of very high degrees) and in acute ulcer, 0.2 to 0.8 (4 to 8 drops) of tincture of belladonna, or 0.0003 atropine sulphate may be given every 3 or 4 hours during the day; in ulcer, the graver the case and higher the amount of fluid proteids taken, the larger should be the dose, and the quantity then cut to one-half or less (and continued) after the physiological symptoms from the drug appear.

The last sedative drug, the use of which is occasionally called for, is opium and its most important alkaloids, morphina and codeina. In very acute abdominal pain of the functional or catarrhal inflammatory types these substances in one or a few doses are the most valuable means at our command to relieve excessive pain. Of course, when such simpler means as a mustard poultice over the area can control the distress—and this is a most efficient means to control vomiting—or an ice poultice, ice bag, or less active medicaments internally answer for the case, they should be employed instead. Under no conditions should the opiates be used in the course of steady treatment of the average case, and not even in the acute pains of gastric ulcer; this however, excepts some of the cases of late cancer in which the relief of pain is about all we can do of benefit in the treatment, and in which it is a matter of indifference whether the habit for the drug is contracted or not.

ARTIFICIAL FERMENTS.

As a legacy from the days of medicine when so little was known about the digestive functions, and when the treatment of them was based upon the flimsiest of data, the use of artificial ferments is still with us. Empirical medicine has much in its favor, but when it persists in the use of these substances in the treatment of digestive disorders, it is conservatism or irrationalism or medical ignorance continued too long. The main reason for the persistency in the use of them is due to the ferment propaganda that was and still is broadly cast throughout the world by the proprietary houses supplying these preparations, and the alluring twinkle that such terms as "pepsin," "pancreatin," "malt diastase," and their combinations in high sounding names have for the much-too-busy general practitioner and the easy-to-impress patient with a digestive disorder. The time will come when workers in clinical medicine will generally learn that, even if the proteolytic ferment extracted from the hog can, in a test-tube, digest 3000 times its weight of egg albumin, such pepsin taken medicinally is a poor makeshift for scientific medicine; and the same holds true with trypsin.

Suffice it to recall that in the human being the ferment content in the stomach is not nearly so often diminished as is the HCl, and that even in what looks as an achylia (where the HCl is absent) the proferments are generally found in sufficient quantities to do the work needed if they would be activated by HCl. The work of Pawlow showed plainly that the gastric secretions vary in composition and strength according to the sort and amount of food ingested, and that it is most doubtful that help may be given by the administration of small amounts of artificial pepsin. Sollman has shown that the preparations of ferments upon the market are almost, if not entirely, inert, either because they have degenerated after preparation, or because they were not active at the start. This is particularly true of the alcoholic preparations and the watery extract when these have been kept any length of time (glycerin being the best liquid medium for its preservation).

For a fluid preparation of pepsin when added to milk to show a quick coagulum, proves only that the milk curdling element (which persists the longer) is at work and not the presence of active pepsin, and it is well known that milk proteid coagulated artificially is less easily digested than the original milk proteid. Rennin action has no essential significance for the digestion of proteids, since it is absent in

the new-born, and its large amount in the adult stomach is the reason for the adult's relatively smaller digestibility of milk as a food.

Added to these is the well-known fact that pepsin is destroyed in an alkaline medium (anachlorhydria, achylia), and that trypsin is destroyed in a weak acid medium almost as quickly (the great majority of stomachs in disease have more or less acid). Then again, when in combination, pepsin destroys trypsin, and trypsin destroys pepsin, and, as was said before, they both deteriorate quickly in all fluid preparations unless most carefully protected. Thus it will be seen that the use of the ferments, plain or in mixtures, is irrational and ineffective, and such benefit as may have been apparent from their use has either been due to other substances that are contained in these preparations (such as an acid and alcohol), other medicaments that had been added to them in the prescribing of mixtures or powders of the ferments, to moral effect on the patient from "taking pepsin," or just to the suggestive fact on a patient of being under a physician's care for digestive trouble and for which they are taking medicine.

The best medical practice is to change the diet in quality and form so as to meet the chemical and dynamic power of the stomach, and to employ such more dependable local means and general measures as may be called for to work this power up to a higher standard of digesting capacity, or down as the case may be.

If one can be sure in a case that there is no acid secretion in the stomach (complete achylia) and the organ is a mere receptacle for food, the use of pancreatin, pancreas powder, or "holadin" and the digestion rendered alkaline with bicarbonate or carbonate of soda, assists in the proteolysis and amylolysis of food, and thus to a better state of digestion and utilization of food in the economy. In these cases the stomach may be considered in function as practically a part of the digestion of the small intestine.

The above remarks on the animal ferments comprise essentially the author's ideas on the therapeutic use of also the vegetable ferments (nepenthin, bromelin, and papain).

STOMACHICS.

The above term has been given to substances capable of increasing the amount of gastric juice secreted. In this particular there is no substance known which by virtue of its chemical action upon the interior of the stomach can directly raise the acid-enzymotic secretion. In my opinion, the substances classed as aromatics (the condiments, orange, lemon, garlic, onion, etc.) can by the smell of them mainly in

foods reflexly cause a short duration of secretion of gastric juice, and the substances classed as bitters (gentianæ, cinchona, colombo, condurango, bitter orange peel, etc.) can increase the gastric juice secretion in the same reflex way, only as the first is by way of the olfactory sense, and the second through the sense of taste. I doubt very much that when once swallowed, unless their effect when taken in large amounts is irritating to the gastric mucosa, any benefit in raising the status of secretion comes from their use. Strychnine or tincture nucis vomicæ leaves the most persistent bitter taste in the mouth of any of the bitters, and it is most probably due entirely to this that the use of it can occasionally raise the amount of stomach secretion, although being an admirable nerve and muscle stimulant it can (when the secretory or motor apparatus of the stomach is below proper function) in the indirect constitutional manner bring about a higher status of secretion. Orexin, which was strongly indorsed by Penzoldt who called it a "genuine" stomachic, has been extensively used in anorexia and low secretion. Given in 0.65 quantities in bouillon before meals it acts in the same way as other bitter substances, namely, by its pungent, bitter taste in the mouth (I have proven to myself that it does not cause the secretion of gastric juice or elevate it when its taste is masked).

The formulas which have served me to the best purpose in stimulating a desire for food and assisting to higher secretion are the following:—

℞ Tinctura nucis vomicæ,
Fldext. condurango .....āā 15.0 ʒiv
Aquæ cinnamomi .....q. s. 100.0 ℥iiiss

Fiat et Sig.: Take a teaspoonful in half a tumbler of water before meals.

Or,

℞ Tinctura nucis vomicæ ..... 10.0 ʒiiss
Elixir gentianæ .....q. s. 100.0 ℥iiiss

Fiat et Sig.: Take a teaspoonful (or two) before meals well diluted.

Or, when constipation is present,

℞ Fldext. cascara sagrada,
Fldext. condurango .....āā 15.0 ʒiv

Fiat et Sig.: Take 20 drops before meals in water.

It is a well-known fact that with the prolonged employment of a diet free from chlorides (salt free diet) more or less rapid diminution of the HCl output in the stomach takes place, and may even disappear altogether, and on the contrary, that the prolonged use of a very salty diet and salty enemas may give rise to an excess secretion in the organ.

For these reasons, and because salt may stimulate the appetite by its pleasant taste, and its necessity as a constituent in the animal economy to maintain good nutrition, its use in larger quantities will occasionally serve to good purpose in cases of subacidity or anachlorhydria. In the same connection it must be remembered that while in moderate quantities it may act as a stimulant, in large amounts it can inhibit the gastric functions. Being well acquainted with two apparently normal individuals whose generous use of salt in foods at the table often created comment, I took advantage of the opportunity and made analysis of simple test-meals extracted from each. Both results proved to be low in the total HCl content (17° and 36° total HCl respectively in the two individuals), although the rest of the analyses were normal. It is probably best to leave each normal individual to his own desire in the amount of salt that he ordinarily adds to his meals, although in the presence of digestive disorder, and since patients do not always possess this sense of salt selection within themselves, it is well to increase or diminish the amounts of table salt taken according to the gastric analysis of the case.

In the existence of what may be generally termed a pathological stomach, proper dieting, the stimulating effects from regular lavage, the local and general tonics, and better hygiene of living are by far the better and more rational measures to employ to "work up" gastric juice secretion than the use of any single means or definite formulas of stomachic mixtures.

OTHER MEDICAMENTS.

Of these the author will only touch upon a few of the many substances that are used.

Alcohol.—Functional and organic disturbances of the stomach are both a cause and effect of the use of alcohol. In all forms (even in beers and light wines which are low in percentage of alcohol) alcohol is a dangerous remedy to employ for stomach disorders, for, while they may stimulate a desire for food and perhaps a higher status of gastric juice secretion, it (alcohol) eventually diminishes the nutrition of the body, and when taken in any quantity (brandy, whiskey) is highly irritating to the stomach walls.

L. Kast[9] in his observations (a case of gastric fistula) regarding the effects of alcohol on the human stomach found that alcohol stimulated the digestive secretion in the organ, and that the duration of flow was increased beyond that possible of stimulation by water or the common food substances, but—important to note—that even in

dilutions of 10 per cent. the increased flow pertained only to the HCl and not to the enzymes. Continuing his experiments upon dogs, he observed that in a dilution of 10 to 20 per cent. the secretion of gastric juice is still more actively stimulated and at the same time the mucus was increased, and that in dilutions stronger than this the secreting time was shortened and the mucus still more increased, over 50 per cent. alcohol producing relatively little HCl and abundant mucus, and over 70 per cent. being a corrosive to the gastric mucosa by its disintegrating effect upon the albumin.

While one may argue in favor of the use of alcohol that it is an active stimulant to HCl and that in small quantities its employment seems to be harmless to the stomach, the above observations prove, in my opinion, that such action as it has is from the very beginning to the end that of an irritant to the mucosa. In depressed states of secretion of a functional type the short time use of a dilute alcohol beverage with meals may be of some practical benefit; still, when one considers the commonly seen clinical sequence from its steady use—hypersecretion, secondary catarrhal process, then the diminution of the pro-enzymes and finally loss of HCl and pro-enzymes from changes in the glandularis with atony of the secreting parenchyma and atony or hypertrophy of the muscularis with thinning out or round cell and fibrous infiltration of the gastric walls—for the treatment of digestive disorders its use might better be left out. In a normal stomach, an occasional drink or two of alcoholic beverage would not be especially harmful—the accommodating stomach can correct itself after them—but since the use of alcoholic drinks first began, and certainly to-day in many races and collections of people in our great centers of life, there is too much social and habitual drinking of these fluids with the meals for safety to the digestive apparatus, not to speak of its baneful effect on the other specialized tissues of the body, or the moral and domestic side of the subject. It would have been far better for the world if alcohol had never been discovered; medicine could just as well have gotten on without it.

Late in the treatment of acute catarrhal conditions of the stomach (subacute gastritis) when a purge seems to be indicated, the use of *calomel* in small-sized doses (0.01) frequently repeated usually acts most efficiently in the desired way, and often is a most practical sedative to vomiting. On these occasions the excellent remedy *oleum ricini*, so helpful at most other times, is liable to precipitate another acute attack with violent pains in the abdomen. ***Bismuth subnitrate*** is a more efficient mechanical sedative in vomiting and diarrhea than is the subcarbonate salt. *Cerium oxalate*, used in much larger sized doses

than is ordinarily recommended (0.3 to 0.6), is often an efficient sedative to the stomach.

Resorcinal (the most soluble of all coal-tar derivatives) in 0.1 doses, and also creosotum in 0.2 doses, are sometimes of value in excessive fermentative states of the stomach and intestines. Creosotum is of no specific value in tubercular conditions of the abdominal organs, or, in fact, nowhere else in the body (in phthisis its sole value is that of a stimulating expectorant). In constipation *cascara sagrada* in fluid or dry extract form still remains the best laxative for continued use; the recently advanced use of *phenolphthalein* for this purpose is too uncertain in its results to depend upon for general use. In more obstinate cases when the taking of enemata is not convenient, refused or not well borne, the following has served me to good purpose for continued use:—

℞ Ext. cascara sagrada		13.0	ʒiiiss
Podophyllin,			
Ext. belladonna	āā	0.5	gr. viiss
Strychnia sulphate		0.07	gr. j

Fiat pil. or tablets no. c (coated).
Sig.: Take one or two at bedtime.

If such more simple means as the taking of fruits, or when the stomach conditions allow of it, the changing of the character of foods by increasing the ingestion of cellulose substances or increasing the ingestion of water would keep the bowels regular, they should always be instituted. But in many cases the trouble with dietetic measures as well as with the use of the physical treatments is that these are not sufficient for the purpose. In those who live very sedentary lives, or who, because of having been constipated for years, have developed atrophic and atonic conditions of the lower intestine, the reading of text-books on the subject of constipation and the institution of the many time-wasting physico-hygienic measures that they enthusiastically advance are discouragingly lamentable in their practical results. Occasionally when a stomach condition has been corrected the patient's bowels will move regularly, but not always. If not, the dietary and possibly the physical methods (exercise, massage, electricity, etc.) may then be tried.* But if these also fail, the simplest medical means should be instituted. And if these also fail, the enemas are better to employ as a steady practice than the continued use of the more drastic

* In a number of instances of obstinately constipated persons I have seen most satisfactory results obtained from the eating of three or more bran gems each day made in the following way: Bran Gems.—2 cups of bran, 1 cup of milk, 1 cup of flour, ¼ cup of molasses, ½ teaspoonful of baking soda (dissolved in hot water), ½ teaspoonful of butter, ½ teaspoonful of lard, and salt to taste. Bake in a slow oven for forty-five minutes.

purgatives that the majority of patients select for themselves when specific advice in this direction has not been given.

References.

[1] Schule: Habilitationschrift, Berlin, 1895, p. 69.
[2] Boas: "Diseases of the Stomach," p. 357.
[3] Riegel: Zeitschrift für klinische Medicin, 1886, Bd. 11, p. 213.
[4] Ewald: Berliner klinische Wochenschrift, 1886, No. 4.
[5] Hemmeter: "Diseases of the Stomach," p. 336.
[6] Cowie and Munson: Archives of Internal Medicine, 1908, vol. i, No. 1, p. 61.
[7] Pawlow: Berliner klinische Wochenschrift, 1908, Nr. 11, p. 542.
[8] Edsall: Boston Medical and Surgical Journal, Dec. 26, 1906, clv. No. 26.
[9] L. Kast: Archiv für Verdauungskrankheiten, 1906, xii, Nr. 6.

CHAPTER XII.

Physical Methods of Treatment in Gastric Disorders.

MASSAGE AND VIBRATION.

In the consideration of the subject of massage the author will confine himself to massage of the abdomen, the indications for its use, and the results he has observed by its systematic employment in gastric disorders.

While his observations have been coinciding with those who look upon hand massage of the general body as a therapy of considerable value, the results from its use in the stomach conditions alone have not been productive of much benefit and often have proven most harmful.

For one and a half years in the author's clinic at St. Mark's Hospital, a number of cases of digestive disorders in which there was plainly a myasthenic or distinct mild degree of stagnation of food in the stomach and intestines were put in the charge of a most conscientious trained nurse who had been a close student of the late Zabdudowski, of Berlin, which authority I believe to have been the best student of massage of modern times. The cases were carefully selected, and not one of them was a case of much local organic, malignant or systemic disorder. Apparently they were as favorable cases for massage as could be found. In every case a diagnosis of the condition had first been made, and only those are considered in detail who came regularly to the clinic for this physical treatment.

The author has his doubts that any form of abdominal massage in gastric cases is a measure of practical benefit. From this series of cases, I have yet to see that, even by the most painstaking method, a tardy stomach can be emptied or even assisted to be emptied of food; or the secretion effected in any favorable way. On the other hand, I have observed cases of irritative states of the glandulature (chronic gastritis, hyperchlorhydria and gastrosuccorrhea, and the pure disturbances of sensation, hyperesthesia, gastralgia, neurasthenia) made definitely worse by the method.

In the intestinal cases of chronic atonic constipation, relaxation and flabbiness of the abdominal walls, distinctly better results were

obtained. Time and time again I was able to prove to myself that in those cases of constipation in which the bowels moved after the treatments, which I may say were not common even in the most simple cases, the resulting defecation was far short of an emptying of the sigmoid of the scybalous masses. In the relaxations of the abdominal walls, wherein one would suppose that hand massage would be of benefit to improve the tone of these voluntary muscles, the results from massage alone were far short of the benefits derived from the abdominal wall exercises alone. The method is of some value, however, to improve the general state of the abdomen as a whole, such as would be found in long standing cases of digestive disorder, or in those who have led a sedentary life, but even in these cases I feel that as good results in the subjective way would have been obtained if the massage had only been given elsewhere on the body (passive exercise).

In the gastric cases, neurasthenica gastrica, and gastroptosis with its neuromechanical syndrome, absolutely no results were obtained from massage alone, and in two cases of simple gastric atony decided harm was brought about by persisting in its employment. In two cases of pyloric stenosis, one a hypertrophic gastritis and the other a persistent pylorospasm, the stomach was quite as full at the end of a treatment as it was before it was begun. Even if such had not been so, I have my serious doubts, that, judged in the light of our latter day knowledge of the physiology at this important point of the alimentary canal, it would have been wisdom to force food through a pylorus into the intestine when this food by insufficient gastric preparation was not ready for the bowels—it is evident that you could only increase the baneful conditions of affairs by so doing. In several instances the nurse forsook the method of Zabdudowski for evacuation of the stomach through the pylorus, and employed those set down by Penzoldt and Stintzing in their "Handbuch der Therapie," with results just as indifferent. Now it occurs to me, that if this woman should have gotten such poor results from massage alone, what are the results possible of being obtained by those whose hands are less skilled than hers were.

Because of the slipping and sliding nature of the stomach and intestines to any hand pressure that is possible of being exerted from without, and because it is a more directional method I believe that the electrically run, large, rounded, vibrator head, sunk deep into the abdomen, will give decidedly better results in the massage way.

Lastly it may be pointed out that any form of massage would be contra-indicated in ulcered or malignant conditions, and also in those of an acute or even a subacute inflammatory nature. Also, where

there is excessive secretion or motility, whether in the stomach or bowels or both together.

It will, however, give the best medical results possible to be obtained in cases of perigastric or perienteric adhesions providing these are not too acute and sensitive in nature, although here surgery offers much better results for permanent relief.

ELECTRIC THERAPY.

Intragastric Method.—It is no doubt probable that the controversy on the use of electricity (intragastrically employed) as a therapeutic agent will continue until the nature of what this force is has been learned, and to what the therapeutic effects of the force is on the human body. To-day, on the one hand, are the results of physiological experiment which decry its value, and on the other the results of clinical experience which many times are most brilliantly in its favor. Even among workers in stomach conditions, a wide variety of results are being obtained. As an instance, Einhorn[1] is of the opinion that the faradic current promotes secretion and the galvanic impedes it; Hoffman, that the galvanic current increases secretion, and Brocci that the faradic augments both secretion and peristalsis. It is the writer's belief that the effects of the galvanic current are of a sedative nature in the relief and control of abnormal disturbances of gastric sensation, and that it has a mild inhibiting effect on some stomachs on the hydrochloric acid secretion, but not as often on the quantity of enzymes; and that the faradic current is a therapy of value in the myasthenic states of the muscular tissue of the stomach providing the pylorus is patent, and also if the deficient musculature has not gone on to paralytic atony. Added to these is an effect (probably complex in its nature) on the abdominal sympathetic system in which the nutrition of the stomach walls as a whole is improved; whether this is due to the massaging of the stomach walls by contracture of the muscle fibers from the current, or is due to some direct action of the current on the nerve endings and centers in the posterior abdomen, I cannot say; and lastly its use is a measure which has some beneficial, still mysterious, effect in the suggestive way on susceptible persons who are suffering from gastric disorders of a neurotic nature.

Whatever may be the nature and degree of controversy that wages on the nonconductibility of the glandulature and musculature of the stomach to the currents in the way of trying to prove that the stomach cannot respond to this stimulus (Meltzer[2]), there is one practical test that controverts it all, and that is that when an electrode is within the

obta[illegible] the current to the
tho[illegible] [illegible] electrode placed
me[illegible] must come through
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w[illegible] [illegible] causes the entire
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[illegible] on the neck, the stimulation
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[illegible] for ten minutes at a séance,
[illegible]ral alkalies and gastric seda-
[illegible] using no other treatment in
[illegible] two weeks, and after a non-
[illegible] and the making of test-meal
[illegible] that the galvanic current does
[illegible] that the sedative and antacid
[illegible] between them was about 1 to 5.
[illegible]ween the two kinds of treatment
[illegible] results achieved, although the
[illegible] was much improved beyond those

[illegible] stomachs that I have obtained
[illegible] out of slow interruptions (long
[illegible] weighted end) with the positive

end of the current given off within the viscus and the external electrode (negative) on the neck, back or epigastrium. The fast interruptions are not of the value in the way of producing results in motor disturbances that the slower forms are, and the same rule holds good when the negative pole is within the organ. The faradic current is used to the tolerance of the patient. Of late, I have been employing with promising success, the combined current (galvanic and secondary faradic) in the same type of cases where there was also existent a sensory or secretory disturbance. The primary faradic is not as beneficial as the secondary is. It must be plain that little good can be accomplished by this method of treatment in dilated stomachs if the dilatation is secondary to pyloric stenosis (secondary ectasia), or has come on most acutely, like the paralytic distention of acute surgical dilation.

The best results from their use are seen in the myasthenics, rather incompletely atonic, which have developed from long standing errors in eating or drinking, or muscle weaknesses which are concomitant or secondary to long standing sensory or secretory disturbances. When the muscle weakness has gone on to extreme atony (atono-paralytic ectasia), the results are liable to be anywhere from most brilliant to none at all. It is impossible to foretell in any long standing atony just what the results from its use would be, but it certainly is worthy of a continued trial in every case, even sometimes in the presence of rather persistent failure. The author has observed cases in which the continued use of the faradic current seemed to be of little service, when suddenly the cases would make a change for the better and the stomach reduce perceptibly in volume, after which the entire picture of the cases improved. Faradism in my hands has served me well in the treatment of neurasthenic conditions of the stomach and intestines, and also in the states of deficient gastric juice secretion (hypochlorhydria, long standing chronic gastritis), and in pyloric and cardiac incontinence. It is also of service in a few cases of simple nervous anorexia.

The galvanic current is of the most service in the irritative sensory and secretory conditions of the stomach. The sensory of these are found in the hyperesthesias, gastralgias, often in neurasthenia gastrica; and the secretory, in gastritis acida, hyperchlorhydria and gastrosuccorrhea. I have observed two cases of post-ulcer-irritated stomachs when it was of much value in maintaining comfortable digestion. It must be remembered that because it is a mildly appreciated current, even when much too strong for a safe use in a stomach, it must always be used in small amounts, 5 to 20 milliampères, and that

Of first importance is the employment of a battery that is capable of delivering all combinations of currents, one in which the rate of electrical flow is well in hand, has a perfect milliampèremeter, a secondary coil of sufficient high tension, and a pole changer. It has been my experience that the transformed current from the direct or alternating commercial currents, as delivered from such wall plates, is decidedly too irritating for intragastric work. At the best, the stomach stands but a small amount of current, and only a few battery cells are necessary to deliver a current sufficient to do the work. It is best, however, to provide a battery which has a greater number of cells, so that as they run down from use and time more current can readily be added to make up the shortage. Such portable chemical batteries are supplied by numbers of good manufacturing houses which make medical batteries.

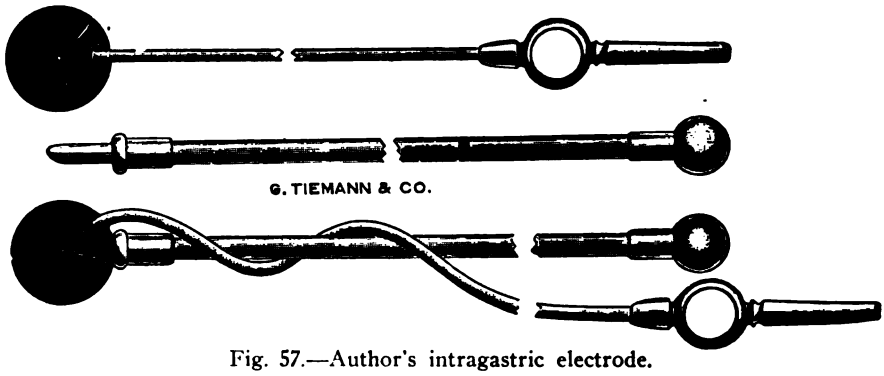


Fig. 57.—Author's intragastric electrode.

It is best to give the treatments along routine lines so that they will be thorough. To these ends forms of external electrodes may be employed; the hand electrode which is moved about, and the large plate electrode which remains stationary covering a large area. The rules that I can give for the employment of these are only general, and naturally would differ in different cases, according to the diagnosis, objects to be obtained, tolerance of the patient, etc.

A treatment should last for from 5 to 10 minutes. The faradic treatments should take a few minutes longer than the galvanic because with the first it is often desirable to treat in addition to the front and back gastric regions also the spinal and general abdomen. The galvanic treatments are more of a local treatment to the stomach itself. The patient being ready, the current is gently turned on. This is then intensified, until in the case of the interrupted current the tolerance is reached, or in the case of the galvanic when the meter points to the

desired number of milliampères. When the combined currents are used, the galvanic should be turned on as mentioned above, and after that the interrupted; it is well to leave the meter on during the running of the combined currents, as galvanic currents often intensify during the course of the treatment.

With the external hand electrode attached to the negative binding post, and the patient sitting, the operator stands at the side of the person and the wet electrode is moved up and down in the gastric region from the cardia toward the pylorus. The long-shafted electrode greatly facilitates in doing this comfortably. The small intestine, colon, and sigmoid can next be treated by moving the electrode over these regions. After two or three minutes, the left lower axillary region is treated, and then the current can be made stronger for the back, where the same general movement as was employed in front is carried out. In cases of myasthenia, atony, and deficient secretion,

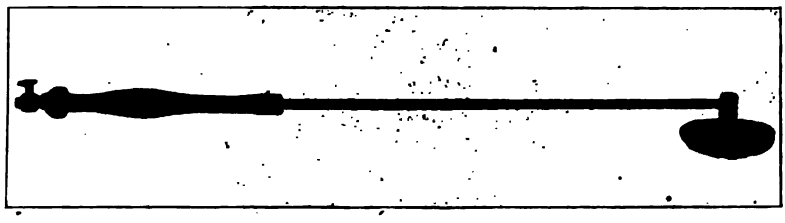


Fig. 58.—Author's long-shafted hand electrode.

it is well to place the electrode on the sides of the neck (particularly the left) for some minutes. The flow can be alternated, when desired, by means of the pole changer. When there are hypersensitive spiral points at the sides of the vertebra, these localities should receive attention, and in cases of relaxed abdominal muscles the treatment may be finished by securing a series of contractions of the side abdominal and recti muscles—all of which are easily and effectively stimulated and exercised. Care should be taken that the current is not strong enough to be painful, remembering always that the wetter the sponge the greater is the intensity of the current.

When it seems desirable to permit the current to flow to a large external area (the back) the large external electrode can be employed in place of the hand instrument. In cases of back pains of a reflex nature (loaded colon, autointoxication, gastric neuroses, vasomotor and sensory disturbances of the gastro-enteron, etc.) this method is of much value when the large plate is placed over the area corresponding to the great sympathetic plexuses in the upper abdomen.

Ready-to-procure large abdominal electrodes can be used for this. The author uses pieces of sufficiently heavy Crooks metal, cut in the desired shape and size for the case and over which he places several thicknesses of a folded wet towel, or, better yet, thick pads made of Turkish toweling. In this way separate pads can be used with each case, and clean ones constantly supplied.

In the employment of the single galvanic current, of usually from 5 to 20 milliampères in strength, much of the treatment should be given over the gastric regions, front, side and back. The hand electrode can follow the same course as above outlined, and some special attention should be paid to the left vertebral region from the seventh to the tenth dorsal, and also the epigastric region easily reached by holding the electrode just below the ensiform. I would caution

Fig. 59.—Hayes' spongiopiline-abdominal electrode.

against the use of a strong galvanic current in the stomach, and would advise the constant moving of the outside electrode, and against the use of the large electrode plates.

I have seen some excellent results with a very low amount of this current (5 milliampères) using the intragastric electrode as the negative end. These were cases of long standing gastritis, where there was probably much thickening in the walls of the stomach (hyperplastic or hypertrophic gastritis). Likewise good results were obtained in cases of persistent hypersecretion where the condition has been of long standing (gastrosuccorrhea chronica, hyperchlorhydria chronica). When the secretion of gastric mucus was increased and a prominent feature in a case, no benefit was derived in the diminution of it. I believe these results were obtained by the softening, disintegrating, or liquefying effect of the negative current, and quite naturally on this account the treatment should not be carried on too

long or the current used in too strong amounts. The negative end stimulates the vasomotor nerves and dilates the lumen of the vessels; the positive is sedative in its action upon the vasomotor nerves of sensation, and controls secretion by causing contraction of the vessels, thereby decreasing the blood-supply to the stomach walls.

It has been my custom to treat patients every second day for two or three weeks, then twice a week for a week longer, and finally once a week until the improvement is permanent. This routine, of course, differs markedly with different cases, some of which are prolonged at the every other day interval for a month or more, and others again, when the case is not very pronounced or makes quick subjective improvement, decreased when the latter is apparent.

What some of the beneficial results that are obtained by the intragastric employment of electricity are due to I am unable to say. But that it is a potent therapeutic measure in well-selected cases when an accurate diagnosis has first been made and the proper current employed, there is no question. No doubt most of the results lie hidden in the mysteries of the great sympathetic system, outside of which the scientific medical world still stands in unshadowed darkness. The method is easy to employ (nowhere near so distasteful a procedure to patients as the passage of the stomach tube), and as they soon become accustomed to it and feel the benefits derived, patients return regularly for the treatments.

Percutaneous Electric Therapy.—In this method the body is treated entirely from without, with the hope that the current employed will sink deeply or course directly enough within the body so as to effect changes in the viscera. In the mass of literature on hand (most of which is unscientific in its nature) all degrees of statements are apparent, all the way from unwarranted extreme optimism, to just as extreme pessimism. Apparently some of these observers claim results from the use of different modalities too often without the basis of a proper diagnosis of condition and proper conservatism and care at reaching conclusions. These wide ranges of reports the author will disregard, and give only his own observations.

It is my belief, based on a quite general use of the different forms of electricity in gastro-intestinal work, that what cannot be accomplished by the intragastric or intracolonic use of the galvanic and interrupted currents, cannot be brought about by any of the externally applied forms, whatever may be the sources of their generation. Taking the currents of a circuit nature as they flow from one pole to the other, they will always take the course of least resistance, and this in the body means the tissues which hold the largest amounts of

fluid or blood. It must be manifest that with one electrode on the epigastrium and the other on the back in the recumbent position, when the stomach sinks away from the front walls, but little or no current would flow through that organ in preference to the better conducting side walls or liver.

This manifestly would exempt the deep-seated pyloric region, and the lung, heart and pleura-covered cardiac end and fundus. Even in extreme distention of the stomach, only a small part of the body of the organ is in contact with the parietal wall (prone position), and the rest of the organ is surrounded with tissue or space to carry off or positively obstruct the direct flow of a current. In the sitting position when the forward inclination of body still further favors it better results might be obtained providing the organ contains fluid to assist in its transmission through the walls. The same problem is also existent in the case of the intestines, but little of which coils are in contact with the front abdomen, and even these are covered by the greater omentum. It is my belief that, unless the applying electrode is sunk deeply into a relaxed abdomen, local benefit is only brought about by indirect means or through moral effect. In the examination of many patients who suffer from digestive disturbances one often encounters painful areas that are reflex in their causation. They are found in the back as well as the front and are the remote nerve-end manifestations of disorder within. Most of them are neuralgic or hyperesthetic in their nature. Ofttimes these areas are quite acute, and the percutaneous use of electricity is a measure of some value in their symptomatic treatment. Among these may be mentioned (leaving out the more general and remote conditions, ulcers and malignant disease), in front, the painful and tender areas of the gastric and enteric neuroses, gastroptosis, chronic gastritis, impacted flexures and descending colon and sigmoid, disease of the gall-bladder and ducts, subacute and chronic enteritis, movable kidney, mucous colic, etc.; and in the back, the diffuse areas of gastric and enteric neuroses, the diseases of the gall-sac and ducts, pains of impacted colon, colitis, debility, renal colic, neuralgia, etc. Among the currents of value for these stands first the galvanic, then the combined, and finally the faradic, using large plates both front and back in all instances.

The various forms of static currents are sometimes of use as a general tonic in the neurotic disturbances of the stomach and intestines, particularly when these are secondary to general neurasthenic states. I particularly question the penetration of this kind of electricity even when delivered as sparks, or directly by the so-called Morton wave current. The high-frequency currents employed as

spinal treatments are also of some value in the treatment of these general neurological conditions. I believe it was Osler who advanced the thought that, a well-equipped, small-sized laboratory was of more benefit to a physician than a dust-covered static machine. I agree with him fully, and would add, that if the time and expense necessary to keep this same apparatus in running order was employed in becoming familiar with laboratory technique, the study of the various reactions, and microscope work, the science of medicine would be more rationally, broadly and logically advanced.

Esophageal Treatments.—In the direct treatment of the neuroses the interrupted or continuous currents are often of value. These are seen practically in the general sensory disturbances of neurasthenia where esophageal symptoms are prominent as reflexes from a neurotic stomach, and in the esophageal spasms accompanying hysterical conditions. I have also observed persistent cases of esophageal neurosis of a sensory nature in women at the menopause period in whom the use of the currents was of much value.

It must be plain that in those cases of esophageal distress caused by gastric disturbances, as well as in the still more general nervous disorders, the gullet symptoms are usually reflex, and any benefits that would be derived from direct treatment of the tube would be more apt to be moral in nature or in so far as these treatments would favorably influence the primary conditions from the general system. Taking such gastric conditions as hyperchlorhydria, in which the constant belching of acid gas and fluids causes irritability of the esophageal mucosa, or the stagnant states of the stomach when the regurgitation is bitter in taste, the best results in so far as the esophagus symptoms are concerned would come from the proper treatment of the stomach condition.

In the electrical treatment of the spasms, however, bright results are often seen, providing these spasms are of the hysterical order and more or less constant in the history of the case. In those spasms which come on acutely after a marked indiscretion of diet in a susceptible neurotic individual, both as these are confined to the esophagus proper or also involving the fauces and soft palate, the treatments are of little benefit; in fact they often aggravate the conditions, which naturally would be best controlled by medicaments of a sedative, emetic, or purgative nature, as may be indicated.

In the organic strictures of a malignant nature, naturally no benefit can be derived. The same is probably true of most cicatricial forms, but recently I experimented on a case of this kind with the following satisfactory results. On the same principle as the electric

treatment for urethral strictures I treated a man, who, as a result of swallowing one or two mouthfuls of a strong lye solution, finally developed a stricture which was annular in its form and situated in the middle third of the canal 27 centimeters below the incisor teeth. At the time I first saw him he was unable to swallow any solid or semisolid foods, and depended for his nutrition upon the constant taking of fluid substances which he partook of in quantities of a teaspoonful at a time. Occasionally he could not even get this past the stricture, and at times resort had to be made to rectal alimentation. The case ran on, sometimes not so bad, at other times worse, until an operation for the establishment of a gastric fistula for the purpose of feeding was advanced. The stricture at all times while under observation was impassable by the smallest sized bougie olive. Feeling that some benefit might be derived from the use of the galvanic cur-

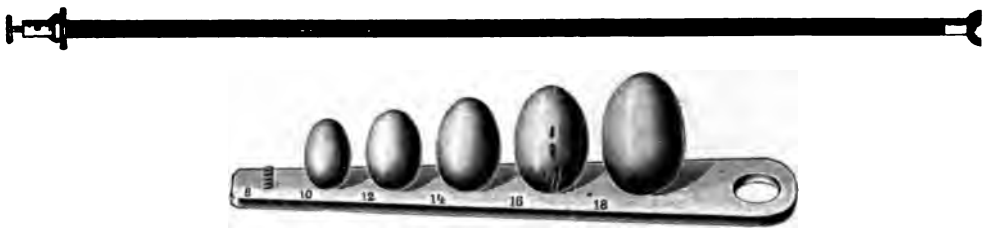


Fig. 60.—Esophageal electrode, which has different sized olives and which can also be used as an esophageal bougie.

rent, I treated him daily using the negative pole on the stricture, and the positive under him from a large-sized plate upon which he sat. The electrode was crowded as firmly onto the stricture as was thought safe. From 15 to 30 milliampères of constant current was employed for 5 minutes at each treatment; the average amount I assume was about 25 milliampères. After the eighth treatment his ability to swallow was perceptibly improved, and 6 days after that olive number 8 slipped through the stricture, and could easily be continued down into his stomach. Two weeks later number 10 was passed and then (4 months after beginning the treatment) olive number 14 could be passed without much difficulty. The patient now swallows solid and semisolid foods, a little slowly to be sure, but satisfactorily well. Apparently not yielding to further dilating, the electrical treatments were discontinued and the patient was provided with a bougie of the number 14 size which he continues to pass on himself daily to keep the canal patent. Whether the electrolysis of the constant current really helped in bringing this result about I cannot say. I am inclined

to believe that it did; and should such have been the case, the method may be worthy of more general trial in these desperate and unfortunate cases of obstinate and impassable strictures before resorting to surgery.

Inasmuch as water, as is used in the stomach for the purpose of carrying the current to the tissue walls from the perforated, hard, rubber-cased, intragastric electrodes, would be of no service when treating the esophagus, the end-pieces of these instruments are made of bare metal. For this reason some care must be exercised that the constant current is not strong enough to destroy the mucosa it comes in contact with; with the use of the faradic current the stiff stem of these instruments is somewhat uncomfortable to patients unless they hold their heads rather far back. The electrode may be slowly run up and down in a patent gullet during the course of the treatment so as to affect the entire canal. The best form of outside electrode to use is the stiff Cooks metal plate cut so that it fits over the spine or entire sternum as may be desired.

X-ray Therapy.—Because of the brilliant results that are brought about by the use of the Roentgen rays in the treatment of malignant disease of the skin and superficial tissues (carcinoma and sarcoma), one would suppose that in the cases of malignant disease situated deeper within the body we had in this therapy a measure of some practical value. At first, when this was used, some very flattering reports of cases were issued, and this, no doubt, established its more general use and brought about the better knowledge of it all that has come in late years. Based upon a rather extensive and free use of the X-rays in the therapeutic way in a number of cases of malignant disease and other types of gastric cases, I report my observations in the main as follows:—

The X-rays (and no doubt all other kinds of light treatments) are of no value in the cure of gastric carcinoma, sarcoma, and even those slower types of malignant disease following chronic ulcer (ulcus carcinomatosum). In some of the late cases of carcinoma, liberal use of the rays from a hard tube will, for the time being, apparently stay the rapidity of a growth. But the cases soon again continue on in the bad way, so doubtlessly no actual benefits had been derived. In the medullary forms of cancer, this is not so liable to occur, and I believe that the systemic symptoms (debility, cachexia, etc.) are made worse by its use—this may be due to a softening of the mass so that there is a greater degree of toxic absorption. Some relief of pains is occasionally brought about for a short time, but this is far short of the relief brought about by the use of morphine. More times the anodyne

effect of the rays is but very transitory, and most commonly no effect is accomplished. It is my belief that when the pains are relieved, it is accomplished entirely in the suggestive way, and not by any beneficial effects of the rays on the growth. In the three cases of inoperable sarcoma (two gastric and one enteric) that I have seen, little better results were obtained in the relief way but all nevertheless rapidly succumbed to the disease. In all twenty-two cases of inoperable or recurrent malignant disease of the stomach and intestines were treated, and all of them went on to the fatal ending with but little benefit from the rays alone.

The author respectfully cautions against depending upon the use of the rays in all early cases of malignant disease. My reason for this is that much very valuable time is wasted. The growths always continue involving the foundation stomach tissues and spread into the adnexa, the organ itself is then lost to proper function and the local pains and systemic states ensue with the rapid development of the deplorable picture of late malignant disease. When the diagnosis is made or is most probable that of incipient malignant disease, surgery offers the best means of therapy, and it is our duty to the patients to bend them in this direction, rather than temporize with outside measures until it is too late. Possibly in cases where an excision was performed, and where the indications are favorable against a return, the rays may be used for a while to guard against recurrence. Even here, I have my doubts that they can be depended upon as of much value, for it is my belief that when the carcinoma cells are still present in the tissues, lymph-spaces, or glands more or less remote from the field of extirpation, the rays could not arrest their propagation and consequent tissue involvement. The value of their therapy is too theoretical, and I question the accuracy of the diagnosis in those cases in which brilliant results have been reported in the curative way. I have also tried the steady use of the rays directly upon a scirrhous cancer of the pylorus. In this case, a long median incision and suturing the stomach to the opening, retained the outer area of the stomach within a permanently left open incision. The case was rapidly fatal even with the daily use of the rays. If, at operation, even an extensive malignant growth is noted and extirpation is too hazardous a portion of the neoplasm should always be obtained. The reasons for this are that the growth under the microscope may prove to be an infectious granulomata (syphilis, tuberculosis), instead of a carcinoma—both of which may be cured or improved by medical means—or the neoplasm may be one of those rare forms of cancer known as an endothelioma for which the medical use of the X-rays may be curative or most beneficial.

As unfortunate as have been the author's results with the use of the X-rays in malignant disease, the very opposite has been his experience with the rays in the treatment of latent and chronic gastric ulcers. I believe that in these cases it is a treatment of much value. Just why this is so I am unable to say, but there is little question in my mind that it is at least worthy of more general application in these cases, and also in most all benign, post-acute ulcer conditions.

Of late I have been resorting to the routine application of the rays in all cases of acute gastric and duodenal ulcers after these patients have left their beds, and I feel that the end-results of the medical treatment in the cases have been vastly improved over the cases in which it had not been used. I am quite sure that the number of cases of half-healed ulcers, spasmed and irritative states of the stomach are fewer with me to-day than they were several years ago, and this I do not attribute particularly to any improvement in plan of medical treatments I now employ. I am inclined to believe that the rays stimulate the mucosa to a better repair of the ulcer, and that the resulting scar is not so stiff. It must, of course, be understood when these patients are under treatment that any concomitant condition, like hyperchlorhydria, or more marked hypersecretion, must receive proper attention in the dietetic and medicinal way or the improved results may not be achieved. The rays should be used in these cases as one of the last measures of routine treatment, after the bed, dietetic, and medicinal care for the acute stage of the ulcer are concluded. With their use a number of the unpleasant sequelæ (carcinomatous degeneration, erosion and autodigestion of the scar, marked contractions of the cicatrix resulting in sacculation or hour-glass formation, perigastric adhesions with the surrounding organs, very irritable states of the mucosa, etc.) will probably be lessened.

In the chronic forms of ulcer, and particularly those found in the old, a resort to these treatments should be tried before the surgical measures of excision or drainage. They may fail as they did in one of my cases (a man 70 years old who had been suffering from ulcer for two years) or they may be of the utmost service (as they were in two cases of chronic ulcer, one in a female nurse of 40, and the other in a man of 72 years both of which had suffered from ulcer for over 3 years). I do not advance this as a substitute for excision or gastro-enterostomy which I look upon as much the better form of treatment, but for just what my own experiences have been in the treatments of the late acute and chronic forms of ulcers, and particularly in the medical care of cases of gastric ulcer in older persons in whom surgical measures within the abdomen have such a high rate of

mortality, or in whom, for general states of health or other disease, operation would be inadvisable.

In the cases of chronic catarrhal disease of the mucosa, forty-six cases of which were treated, no benefit was derived. Two cases of hyperplastic, three of hypertrophic, and one of atrophic gastritis, claimed subjective benefit from the treatment, but this I was never able to prove to myself with the various test-meal examinations I had made in the cases; no doubt it was mostly moral in its nature, although the discutient effect of the rays may have had something to do with the benefit in the hyperplastic cases. I have had no experience with its use in the true neurotic affections of disturbed secretion, motility, or sensation, considering many of these cases too impressionable to suggestion for accurate conclusions. In hypersecretions of a chronic type the prolonged employment of the X-rays should be tried before operation. In these cases it is not unusual to meet with those in whom marked benefit is brought about probably by an atrophying effect of the rays on the cells in the secreting tubules.

The essentials for the giving of this treatment are a tube of sufficient hardness to pass the rays deeply into the abdomen and a coil with its accessories or a static machine of large size. My results were obtained with the coil, although I feel that one of the high-speed static machines may be just as useful to give sufficient current for penetration. The treatments were given to the patient in the prone position, the stomach always being empty of foods. They were treated regularly every other day unless the skin showed the permanent blush seen before the development of an X-ray dermatitis, when the rayings were discontinued for the time being. Most of the cases were treated with the large-sized, open tubes of the Mueller type, and those in which just the pyloric region was singled out for treatment were treated with the lead glass tubes with the flint-glass window to permit the rays to come through. It has been my custom to first stand a patient between the tube and a fluoroscopic screen and turn on the current until a fair glow with the outline of the spinal column was seen from the rays passing through the abdomen. The quantity of current was then noted and the patient given like amounts in each of the treatments. In slimmer patients not so much current was employed. The use of the Roentgen rays in the diagnosis of stomach diseases is found in Chapter V.

ELECTROVIBRATION.

Having been somewhat discouraged with the results obtained from hand massage and vibration alone in the treatment of the gastro-enteric conditions in which these measures seemed to be indicated, and having obtained on the other hand some satisfactory results with the use of the constant currents intragastrically applied, it occurred to me that possibly in the atonic, low secretory, or mysterious sympathetic disturbances, benefit from these externally applied physical measures (the currents and mechanical massage) would be enhanced by the combination of these two and applying them at the same time. Along these lines to simplify the work, I devised a new vibratode head which would also answer as one of the poles for the constant or interrupted currents.

It was my feeling that by combining these two fair measures of therapy the benefits of each would be enhanced bettering the doubt

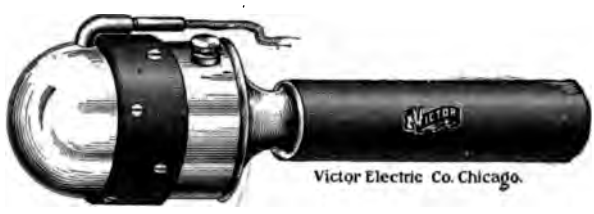


Fig. 61.—Author's electrovibratode, showing insulated end-piece.

or failure of results from the handwork or the percutaneous use of the currents. In this I feel that I have been moderately successful in the treatment of some of the nutritional, neurotic, atonic and catarrhal conditions. I have observed that of the forms of massage itself, the vibratory method gave much better results in the deep abdominal conditions than the hand method—it is more effective and directional—and then, because the one applying electrode (vibrator head) was sunk deep in the relaxed abdomen, one could be more sure of direct effects from the current as it passed from above downward or *vice versâ* than would be the case by the use of the plates or sliding hand electrodes.

In the disturbed states of motility, sensory and secretory conditions of the stomach, the results from the treatments were somewhat better than with the single forms of these physical treatments. Often the combination of the constant current with the vibration showed results in the relief of pain and distress in the simple sensory and secretory conditions (this may have been due entirely to the current

alone); and in the atonies, the use of the faradic currents was sometimes quite encouraging (this I believe to be due to combined action of the two). The best results in so far as the stomach was concerned were seen in those cases in which the gastric disturbance was secondary to enteric disturbance—for in the treatment of selected cases of the latter, the treatment is particularly well worth the while. Taking my experiences in mass, and stating it briefly, I feel that some of these cases did better than if they had only been treated by the generally established older time clinical methods alone. And even if I cannot explain this to my own satisfaction, I state it with a firm conviction that the moral effect of the treatments, or just the dietetic or medicinal results always employed did not have all to do with it.

Of the clinic cases treated, I observed particularly four cases of chronic membranous colitis of long standing, which, under treatment for from two to seven months, made decided general physical improvement. In two of these, the constipation was markedly relieved; in another, only moderately so; and in the fourth one not at all. In one of the last two a thin mucous discharge from the lower colon of seven years' standing was stopped, and the quantity of tougher mucus from above the colon was decidedly lessened. Two of the other cases showed less passing of tough mucus, but in the remaining one (a marked coloptosis) there was no apparent difference in this local way. None of these cases were treated at the same time by colonic irrigation (which in my opinion is the best single method of therapy for these conditions), but other measures, such as cascara, tonics and so on, were also used. I feel that this method of treatment is worthy of more extended trial in those more or less chronic cases in which results from treatment in the past have been so few. A case of dilated transverse and descending colon made marked subjective improvement and the return of the gut to a more normal size. Three cases of general tardy condition of the intestines (myasthenia entericus) were treated; two were entirely relieved, and one in which the condition was due to a depressed mental state showed no improvement. Three cases of neurasthenia entericus claimed and apparently received much benefit from the treatments. Up to the time of writing I have used this measure, steadily kept up, in 27 cases of ptosis, comprising about all the grades and combinations of abdominal viscera prolapse that are clinically seen. Although none of these showed much change for the better in the anatomical way, 24 of them claimed benefit, and in 22 of these this was plainly apparent. These, however, were the cases in which I feel that the moral factor worked the strongest, and again most of them would no doubt have improved by the

method of higher feeding, abdominal exercises, supporting measures, and so on that were also employed. A case of recurrent enterodynia of two months' standing was discharged well; possibly here the galvanic current alone would have achieved the result, but the patient claimed that he felt better and was longer without pains when the slow, deep vibration was given with the galvanism, than when the latter was used alone.

It will be plain from the above report that the measure is of more value in the treatment of the enteric affections rather than those confined strictly to the stomach. Summing up my experiences in a broad way I have advanced the following (Bassler[5]) :—

"Electrovibratory massage is of value in the therapy of abdominal conditions in all motor, some sensory and a few secretory disturbances of the intestines, both locally and as they may directly or reflexly affect the stomach or other parts of the body; that it is a measure of value in the disturbed states of local nutrition of the reachable abdominal organs, and in the abdomen as a whole—its influence here is to better the general state of health and favorably influence those catabolic and neurasthenic conditions which take their origin in the abdominal cavity; that it is the best single medical measure we have to-day in the treatment of exudates and fibrous adhesions found about the abdominal portion of the alimentary canal; that in those mysterious, tardy forms of intestinal indigestion, and also in the long standing catarrhal conditions, it might be employed with satisfactory benefit to a patient; that it is the best form of percutaneously applied physical treatment we have for abdominal conditions, ahead of hand massage, vibration, or the externally applied battery currents; that its use should always be preceded by an accurate diagnosis, since in some of the conditions of the gastro-enteric tract it might do positive harm (malignant disease, ulcers of any type, acute catarrhal and suppurative states); that following a plausible indication for its use, it should be employed by the physician himself, or under his immediate direction, in suitable combination for the case in the way of the plan of massage and selection of the current; and that, lastly, it should then be employed with a consistent and, if needs be, long kept up effort to accomplish these ends."

The vibrator I would recommend is the long shafted, motor run type, capable of delivering the long slow stroke. The currents used were the slow or fast interrupted faradic, the straight galvanic, the combined galvanic and faradic, and the interrupted galvanic. The faradic up to the tolerance of the individual was used in those cases in which muscular or general stimulation was indicated; the galvanic,

of from 5 to 10 milliampèremeters, plain or interrupted, for its sedative action on the nerve terminals in the gastro-enteron, either in the way of an effect on the sensory or secretory disturbances, or both; and the combined was a union of the above for the more complex conditions; here the faradic side should always be turned in first. The vibrator head was usually the positive pole and the treatments lasted ten minutes.

The patients were treated prone on a long heavy table with their knees raised and separated. Toilet powder was used on the abdomen so that the vibrator could slip easily; this did not interfere to any appreciable extent with the passage of the current and rendered the treatments more pleasant in every way. Effort was made to retain their abdominal walls lax so that the instrument could be sunk deeply. The plan was somewhat different in the various cases according to the massage routes of the organ or organs treated—colon, small intestines, stomach, abdominal walls or entire abdomen—and also according to the character of the currents and the choice of the anteriorly applied poles (whether positive or negative).

RADIUM THERAPY.

With the hopes that the topical application of radium may serve of benefit in the treatment of cancer of the esophagus or stomach, Einhorn devised a capsule(into which the radium is placed) to which is attached a string to insure its return from the stomach at the termination of the treatment. The instrument is introduced the same as that of the stomach bucket of the same author, and is left in the stomach about an hour for each treatment. The esophageal instrument has, instead of the string attachment, a tubing and mandrin to push it well down to or into any stricture of the gullet that may exist.

The deviser of this appliance states: "In regard to the action of radium in cancer of the stomach, I have treated too few cases to form a definite conclusion. It seems to be of palliative benefit. In cancer of the esophagus I have had more experience with this mode of treatment. I have applied the radium 0.25 gramme (curie 20,000 strength) daily in about 20 cases and have achieved an improvement in most of them—the improvement could usually be observed after a week's treatment, at times earlier."—"The results obtained were very satisfactory."—"In the methodical application of radium we have the means to influence favorably the course and seat of the disease and to retard its progress."—"This mode of treatment is certainly destined to play an important rôle in the therapeutics of cancer of the esophagus

and deserves to be tried on a large scale and in a thorough manner." (Einhorn[6]).

Up to the present time I have assiduously treated with radium 7 cases of gastric and 4 cases of esophageal carcinoma, and must confess to a very general failure in them all. In the stomach cases absolutely no benefit was derived that I could learn. Of course these four were all late cases in which but little must be expected from any form of treatment, but I have felt that if there was any virtue in radium in only the palliative way it might first be seen in an anodyne effect on the relief of pain; in this it was barren of results. I feel that should any physical treatment be employed in these cases the X-ray, by its greater diffusion and because of its more positive effect on cutaneous growths of a malignant nature, would be the better means to employ, although my doubts of its value extend also in these.

In 2 of the 4 cases of esophageal disease, relief of pain and better ability to swallow was evident; in the remaining 2 the results were negative. Whether the benefit was brought about to any extent by the action of the radium itself on the malignant growth I cannot state. In these first 2 cases it was apparent that the careful crowding down through the stricturing mass of the radium capsule at each treatment brought about a more permeable passage with resulting benefits in the ability to deliver into the stomach fluid or semisolid foods. I feel that the relief of pain and subjective improvement for the time being were due to this mechanical dilatation alone, and not to the action of the radium.

Only second to the dread of a slow impending suffocation is the subjective horror of being unable to swallow foods. These esophageal cases usually come to us rather late and when this fear is well established. The radium capsule with its introducer is an ideal, small-sized esophageal bougie, one that often makes its way through a rough and hilly growth better than the regular esophageal bougie would which has a stiffer whalebone staff (on the same principle that a filiform will worm its way through a firm and uneven stricture of the urethra which is impassable to a stiffer form of instrument). Of late I had constructed, for a case of malignant disease of the gullet, a small ivory esophageal olive on a rather pliable thin steel wire, and used this with as much relief to the patient as I had obtained in the 2 cases mentioned when I had employed the radium capsules. On this case mostly I base my belief that the reported results from the radium are mechanically brought about rather than specific from the radium, and those cases are usually such pitiful ones that relief in

this way might easily lead one astray in deductions beyond those that are warranted. In malignant disease of the esophagus the early establishment of a gastric fistula for the purpose of maintaining nutrition still offers the best results that can be given to a patient. It is hoped that the new operation of esophagogastrostomy will be helpful in cases of malignant disease of the cardia.

MECHANICAL MEASURES OF SUPPORT TO THE ABDOMEN.

This form of treatment for affections of the gastro-enteric canal aims to raise and sustain those of the abdominal organs that are lower in position than they normally should be. In clinical observation, these organs in the order of the commonness in which they are observed, are, the stomach, small intestine, colon, kidneys, liver, and spleen. The prolapse may be of a single organ (gastroptosis, nephroptosis); any combination of two or more (gastro-enteroptosis, gastro-nephroptosis); or a rather complete picture of ptosis of most of the abdominal organs which possess mesenteric attachment to the confines of the abdomen.

Of late years the subject of ptosis has awakened a widespread interest, and more attention is being paid to the details of these orthopedic measures of treatment than heretofore. Rightfully this should be, for now many cases of this nature, which in former years were classed among chronic affections, are not only immensely relieved of their subjective symptoms, but are positively and materially assisted to the ends of complete relief and permanent cure. To these ends have been employed abdominal belts of various kinds, adhesive plaster strapping of the abdomen, the use of pads to directly support the displaced organ, and corsets.

So many varieties of these have been advanced by different observers, and the indications for their use and the best type of support to use for an individual case being so different, the author will confine himself to his own ideas in their selection and construction, and a rather complete offering of those with which he is the more familiar.

The usual abdominal bandage that is employed for the purpose possesses, for the great majority of cases, one main fault—it is built too straight in the transverse way to properly sustain the organs. These same belts must be worn low over the hips to have them fit snugly enough to keep them from riding, and thus they are placed about on a level with the sacral region and consequently simply com-

press the abdomen backward. It must be plain in this event that no organs are raised until the anteroposterior diameter of the abdomen has been sufficiently decreased so that the organs will ride upward from this pressure. This makes it really a long way upward, and in many medium, and all thin subjects, my X-ray observations have proved that it is only a poor way at best. Now the object of a belt is, in addition to being a circular support to the entire abdomen, that it must also act as a sort of artificial mesentery so as to shorten the laxity of the natural supports within.

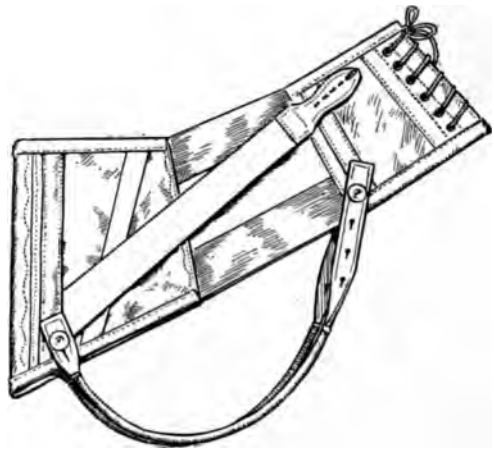


Fig. 62.—Author's belt, showing mesenteric strap in position. The body of the belt is constructed so as to take a very low purchase in front and the highest possible point in the rear, which is generally gauged by having the top of the back of the belt fit well into the waist line. The front and back are made of inelastic material; the mesenteric strap and side are made of elastic webbing. The body of the belt must fit snugly and evenly with the perineal straps (which are indispensable), just taut enough to keep the belt from riding.

This uplift is not possible unless a belt is constructed with these ends in view, namely, built low in front and as high as possible in the rear (the upper border of the back of the belt should fit well into the waist line). It is obvious that no belt which is loose on the patient would serve to be of much or any value, and this brings us to the cause of the length of debate on the value of belts in the first instance.

It has been somewhat of a surprise to me, after a diagnosis of prolapse has been made and the wearing of a belt advised, that more attention to the details of its construction, fit, and what it is to accomplish in the desired way are not given. Accepting a case in which the wearing of a belt would be proper, do we do full justice to

our patient when we leave this matter to the surgical appliance maker alone and then await reports from the individual in the way of derived benefit? Surely no physician would be thus satisfied in a case of hernia in which he advises the wearing of a truss. No, he would request the patient to return with the truss, and when properly adjusted in place insist upon him sitting with his knees far apart and with an effort of straining or coughing observe if the truss properly prevents the gut from coming through the ring under these favorable conditions for its doing so. Why then is this fact any less so in the case of an abdomen, on the surface of which nothing is apparent in detail in the way of prolapsed organs. A hernia is a visible thing, but not the other condition. We are the ones, with our skill in diagnostic measures, who must stand monitor and be responsible; for if this simple detail was observed more generally among the profession, belt wearers for these conditions would not so commonly flit discouragingly from belt to belt in a search for relief and more benefit from the wearing of them.

Manifestly, it must be understood, that even the best forms of abdominal bandage could not serve the purpose in all cases. In fact they are only the few cases in women, and, because men cannot wear a corset, somewhat more general in men. To serve well, we must have a large and bulky abdomen to deal with so as to make a belt fit snugly and enough bulk of tissue to take advantage of in the way of pressure. It is this bulk that gives to late pregnant women the benefit from such supports. To order a belt for a small or flat abdomen simply soothes the conscience, without taking into consideration the all-important fact that, whatever the belt and however well it may fit, this abdomen will slip around on the inside of the girdle and thus it will bring no benefits. Where could come the mechanical benefits of such a garment in many of the cases of gastroptosis that we see in young women and men, long-thoraxed and abdominally slim as they usually are? That brings us abruptly to the point of where it is best to use the abdominal bandage.

The ideal case is the one of splanchnoptosis which follows successive pregnancies—the so-called Landau cases because first described by him. These women because of laxity of the abdominal walls, usually present an [illegible] profile is more or less [illegible] and prominent [illegible] umbilicus. Many of these [illegible] people, who are busily [illegible] large families. Most [illegible] and thus suspend over [illegible] of skirts which serve

to drag it down still further. Then again, is seen the rather thin and poorly nourished woman, sometimes of the better classes, who presents a more or less complete picture of abdominal prolapse. With the sagged stomach she usually also has a coloptosis with one or more movable kidneys, gives a history of a long standing colitis, an obstinate chronic constipation, and a running account of dyspeptic disturbance of years' standing. This woman, although much poorer developed than her sister of the first type, still has a bulky abdomen, somewhat smaller than the Landau, but yet very prominent for her weight and build. With her, freedom of movement of the body and abdomen above the belt would be of advantage in the general way,

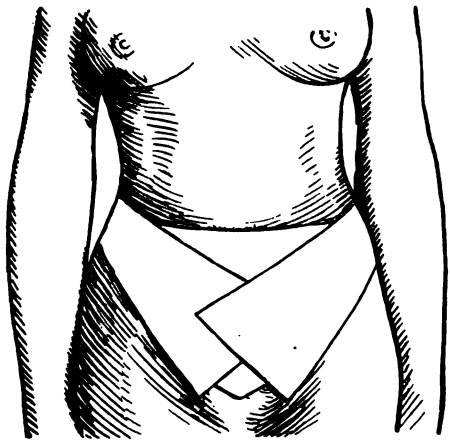


Fig. 63.—Adhesive plaster belt of Dr. A. Rose.

and thus a belt would be best for her to wear if only for the time being. Lastly, are the men of all types who because of their sex cannot wear a corset, and in whom the only choice lies between an adhesive plaster belt with its disadvantages, and a belt depending upon certain extra measures, like the use of abdominal pads and so on, to serve him in the support. In those very thin men with flat abdomens the transverse belt made of all elastic webbing on the order of Lockwood's (which I believe to be the best of them all) is often the only style of support we can employ. And it might also be stated that in these men, built straight as they are all through abdomen and hips, the transverse belt serves in its one single instance of advantage. Of late I have succeeded in fitting some cases of marked degrees of ptosis in men, usually of the coloptotic type, with a belt of the form shown in the illustration in which the front apron

is fitted with concave steels on the order of the front of the corset I use excepting, of course, that these stays are shorter than in the corset.

Adhesive Plaster Strapping of the Abdomen.—Of the methods of strappings that will serve to good purpose are particularly those suggested by Rose, and the one of Rosewater. I am somewhat inclined to favor the Rose belt, for the reason that it is simpler and answers the purpose admirably. It has been my experience that the ordinary adhesive plaster when constantly worn is too irritating to the skin, and that it soon becomes stiff, wrinkled, and thus most uncomfortable. Therefore, I favor the zinc oxide facing (which is less irritating) on mole-skin (which is softer and more pliable). This plaster in proper widths and five- or ten-yard lengths is now readily procurable from manufacturing houses.

In the selection of this belt, the plaster is cut in lengths long enough to overlap well across the back. It is then folded end to end.

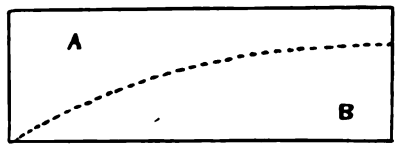


Fig. 64.—Cutting of the plaster.

and cut from the lowest edge in front to the upper part of the ends of the strip like the diagram.

This makes three pieces of plaster; the large apron for girdling the body (A), and two long lower pointed strips (B). Piece A is applied first by sticking the broad end as low in the front of the abdomen as possible, and then swinging the small ends as tight and as high as possible to lie flat around the body in the rear, one and overlapping the other across the back. The lower edges of this piece should not include the crests of the ilia. The smaller strips are next applied low from the hypogastric region, across the inguinal, over the iliac, and across the back over the under piece.

This form of belt when properly adjusted is a valuable appliance. It possesses the advantages of being quickly put on any type or size of patient without much preparation, measurement or expense. It is also a most tight-fitting support—a sort of inelastic new abdominal wall. In my experience, however, its use cannot be depended upon as a support much over two weeks, when it must be removed and a new one adjusted.

It possesses some very marked disadvantages which cannot be obviated. When continually worn, it becomes locally very uncomfortable and irritating to most skins. No matter how carefully we adjust it, from the movements of the body the edges of the plaster curl over and adhere to the underclothing. It soon becomes wrinkled, board-like, and worthless as a support, after which the discomfort and trial of taking the plaster off and the alternative of putting a new one on again are anything but pleasant to many sensitive persons. Then, again, the person is deprived of his bath while the appliance is on. Consequently its employment is not altogether satisfactory. But this much may be said for it, that when a quick relief from symptoms is desired for just a short time, or until a more comfortable support can be made up, its employment is well worthy of consideration. It has also been my experience that, because of the difficulty in securing a good fitting belt for male patients with slim abdomens, it serves to better advantage for them even for continued use, and may be kept up until improvement has been brought about.

Pads.—Pads of various kinds, shapes and sizes are used as accessories to belts and corsets. Naturally, the details in construction of all of these need not be entered into here. The common use that they are put to is for the purpose of holding the kidneys in better position. They are usually worn fixed to some part of the side of the belt, or are slipped loosely inside of it, depending upon the tight fit of the circling garment to hold it in place.

On the whole the use of most of them is a presumption upon the intelligence of both the physician and the patient. It requires no experience to observe or stretch of the imagination to deduct that they are worse than useless. They are rarely in the same place twice, and even if they were no benefits in any direct way could come from their use. I have never yet seen a kidney or stomach held in place from their use, and if the pad became displaced to above the organ it would serve to drive the organ down still further.

One of the amusing incidents in the medical tenacity to their use, is to see a patient with a belt on pull out and slip back a so-called kidney-pad with about as much facility as one would draw and return a watch into a vest pocket.

Of occasional use with men, and women patients who cannot afford to purchase good made-to-measure corsets, is a large sized pad to comfortably cover the entire lower abdomen so as to increase the pressure or support offered by the belt or a straight front corset. A pad I have used for years under these circumstances, and one which often gives signal results, is one made of a thin but sufficiently stiff

leather to give it form, and on which, on the abdomen side, is a cushion of curled horsehair covered with kid.

The lower edge of this pad fits into and just above the arch made by the anterior superior spines of the ilia, Poupart's ligament, and the symphysis pubis. The upper border extends to just below the umbilicus, and the lateral edges well over to the sides of the abdomen. The cushion is thicker at its lower edge than above. Such a pad is soft and pliable, and readily adjusts itself to the body and outside support. It is very comfortable to wear, although it is warm for summer use. It can be fastened securely inside of the belt, or one-half of it can be attached to one side of the corset. Usually, however, with most common corsets and with a tight fitting belt, it remains nicely in place.

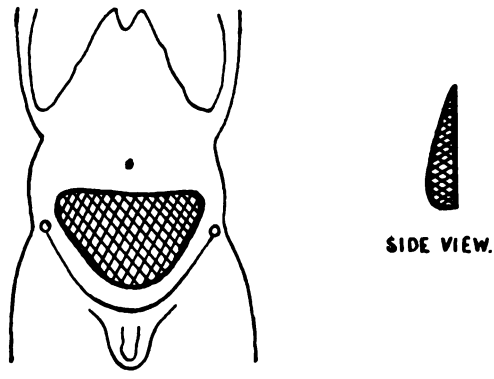


Fig. 65.—Large abdominal pad to be held in place by belt.

Corsets.—A properly made, well-fitting corset always offers the best solution of support for women. It may be said that while the wearing of waist compressing corsets is responsible for the production or aggravation of many of the cases of ptosis that we see, another corset especially constructed for the purpose and not any less fashionable than the first can be made and comfortably worn to correct it.

Most of the present kinds of ready-made corsets, like shoes, are made for sale and fashion rather than for necessity. The corset on a form in the show window is admired, the fashion plate consulted, and then many of our stylishly inclined women change the contours of the body to meet this new fashion. An inch or more girth to the waist-line in many of these women harbors terror in their minds, and thus a corset is selected and worn which is smaller in this dimension than it rightfully should be, with the inevitable result of a surrounding

compression which exerts itself upon the liver, interfering with its function; from that organ to the kidney, pressing it out of its physiological position; on the stomach forcing it downward and distorting the pyloric end and setting up dragging pains in the epigastrium, increased gastric fermentation from stagnation and neurotic disturbance, intestinal disturbance, constipation, etc.

A corset of the proper kind, should be long enough to come well down over the pubic bone and flare of the hips, should not come up too high on the thorax, and should be loose enough above the umbilical line to allow for full play of the lungs and the organs immediately below them, all of which raise and fall in respiration. A tight fit at or about the epigastric region interferes with the normal change in size and position of the stomach when it is distended with food. Pressure at the lateral sides of the lower thorax may safely be exerted to shape the garment and give support to the kidneys when these are low, but this narrowing should be allowed for by a corresponding increase in the anterior dimensions of the garment when it is on.

As women differ in their faces, so they differ in shape and dimensions of their bodies. Therefore it is that ready-made corsets which are made up in numbers all the same way, like ready-made garments, cannot serve for our purpose. These garments should always be custom-made, and accurate fitting to the body.

The best corset of this kind is the one built on the lines suggested by Gallant, which are simply those of a perfectly fitting garment. This corset, however, is a too generally tight-fitting garment, which in my clinical experience can be improved upon when we have a definite function for the corset to perform,—namely, support to definite abdominal organs that may be prolapsed. My X-ray examinations of the lower border of the stomach before and after this corset was on, have proved this to be the fact beyond the less than two-thirds number of women who are subjectively benefited by its use. But in the average run of rather stout women, where just a single kidney is loose with the stomach or a slight general prolapse of the abdominal organs, it answers well. It is a stylish looking garment, and women like it. It has always been somewhat of an objection to me to have the corset fit as tightly over the hips as Gallant advises. This binds the lower body and squeezes the rather flabby subcutaneous tissues found in many of these women. Furthermore, I am not in favor of the strings being loosened each time before the corset is put on, because of the difference in the degrees of approximation of the back borders of it at the successive wearings—thus differences in the degree of support. This is not a very serious objection however,

since, after a little attention to it most women fasten the garment about the same each time.

It must be evident, in those Simon-Pure cases of single organ prolapse seen in the young unmarried women of slim and medium build where there is a flat abdomen to deal with, that a straight-front corset with a shaping to the abdomen would not serve much in the way of lifting the organs. It would answer well as a wall against

Fig. 66.—Author's corset on an extreme case of gastroptosis in a medium-sized young woman in whom the corset raised the pyloric portion of her stomach eight centimeters with almost immediate relief of the gastric distress after eating, complete relief of constipation, and marked subsequent benefit to her general health.

which, under such an act as deep inspiration, the abdomen would be held back. Then again, if this style of corset is pulled very tightly around the hips, so that it violently compresses all of the external soft tissues, a uniform pressure is exerted to a central point in the interior of the abdomen. At this level there would be a generally exerted horizontal decrease in all of the diameters, and thus it would serve to raise the viscera. But is such a degree of circumferential pressure wise when corsets especially made in front can be employed which

would raise the organs better, and be just as stylish in their design and curves, be generally loose so that deep abdominal respiration and more or less abdominal exercise is possible, and which (most important of all) can be constructed in varying degrees of depths of the abdomen so that the extent and direction of uplift can be accurately exerted according to the requirements in the individual case?

Such a type of corset has been advanced by the author (Bassler[7]) and further use since then (370 women up to the time of this writing) has established its practical value, its general comfort and definite support to prolapsed organs, and its desirability from the standpoint of fashion. It is a daily observation with concerns and individuals who fit these women with one of the many kinds of corsets now offered

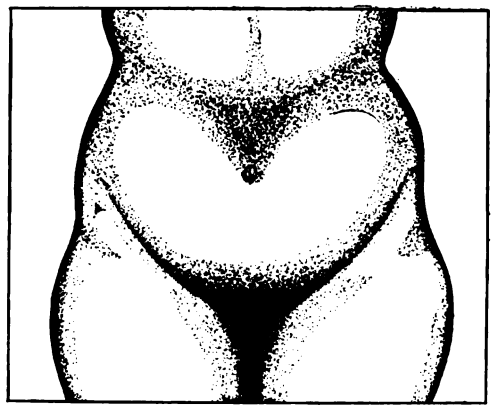


Fig. 67.—The double, wing-shaped, light portion of the abdomen shows the area that is reduced by the concave front of the corset.

for sale that benefit is being given by their particular form of corset. Taking all cases of ptosis together in which no complications exist, the satisfactory ones comprise about two-thirds of all, although even in these X-ray examination with the corset on fails to show that a perceptible degree of uplift to the stomach or colon is exerted. This leaves one-third of the women who receive no clinical or subject results from their use, and it is with these that my corset has been useful. I therefore argue that if the latter are improved by it, all of the first two-thirds also are, and this has been my steady observation.

With women who have a large, low hanging abdomen, the concaving of the corset is not required. Because here you have sufficient bulk of tissue to take advantage of for the purpose of raising the viscera—here an ordinary made-to-order, straight-front corset answers well. But up to the medium large abdomen it is always advisable to

use the concave abdomen to the corset. If we examine many of those pendulous abdomens from the front (standing position of the woman), the bulging is noticed somewhat double wing-shaped, each wing extending from the linea alba below the umbilicus upward toward the flanks. This is generally observed in extreme cases of generally relaxed parietes, and even in the cases where there is not much diastases of the recti to allow for extra central fullness to give it a globular shape.

With this type of case, because of the fascicular and interfascicular muscle stretching (also the fascia), caused as it is by the long

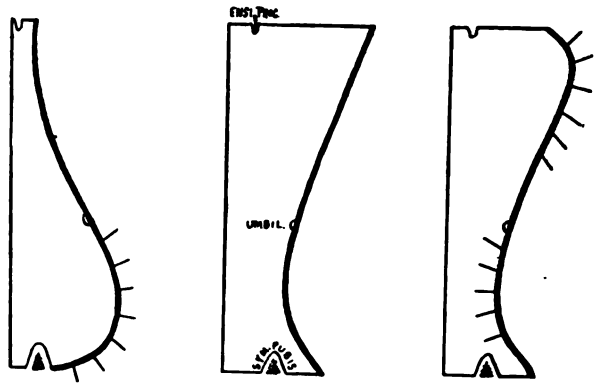


Fig. 1. Fig. 2. Fig. 3.

Fig. 68.—Schematic plan, in profile, of the author's corset. Fig. 1 represents the type of low sagging abdomen commonly seen in cases of splanchnoptosis. The radiating lines show the directions in which the pressure of the viscera is exerted on the walls. Fig. 2. The corset, when closed, showing the concavity below the navel and the straight line above so as to further sustain the raised viscera. Fig. 3. The pressure lines of the corset (below), and the resulting bulging of the upper abdomen (above).

standing *vis a tergo* of the organs within, the abdomen muscles are more or less tonic. This is plainly evident by the poor control, and weak power of contraction of the muscle planes. The concave corset reduces this prominence, and bending the muscles backward, permits of better circulation through them, a retraction and rearrangement of the fibers, so that after a few months of wearing the corset the abdomen is not only generally smaller at this level, but often a distinct flattening is observed below the navel when the abdomen is viewed in profile. All this desirable change is due to the pressure effects of the lower part of the corset in front.

For the very slim, long-thoraxed women its service is most perfect. No other style of corset or other appliance serves nearly as

well to sustain to higher levels the prolapsed organs. Her abdomen is too flat for any service from a belt (adhesive plaster or otherwise), and also all forms of corsets that are built straight in front. By the concave steels these organs are held steadily in place, with a relief of the subjective symptoms, and a usual gain in weight—a most desirable change to be brought about in all of these cases.

Fig. 69.—Author's corset with medium curvature on a case of gastroptosis with palpable and movable right kidney in a very slim woman, who was 5 feet 11 inches in height and weighed 110 pounds. The pyloric extremity of her stomach was raised five centimeters, with relief of her gastric symptoms and a gain in her general health and weight amounting to 12 pounds in the first 2 months, and 17 pounds in 5 months.

Before a corset or other form of support is applied, an X-ray picture (when the stomach or intestines are low), as Pfahler has suggested,[8] should always be taken, followed by another after the support is on. This is necessary in all instances so as to note that the garment is performing its intended work. Should it be noted that the uplift is not as complete as it should be, steels of deeper curving can be put into the front of the corset. In the cases of the nephroptosis mostly, or where there is the more general state of ptosis, the X-ray

examination is not of much service, and we must depend more upon the relief of the subjective symptoms and general improvement in health.

All garments for these cases should be put on with the patient in the recumbent position. This permits the organs to sink backward and upward to higher physiological planes within the abdomen, and is on the same principle of first reducing a hernia before putting on the truss. In the case of the corset here advised, it is wrapped around the body while in this semi-opisthotonos posture, when possible, without the preparatory opening of the strings, and the lower eyelet is then closed. While still in this position, and under extreme exhalation, the rest of the hooks are fastened in place, after which the woman rises from the bed and completes her dressing. Under no conditions should the corset be put on while the patient is standing or sitting, because holding the abdomen up with one hand or drawing it upwards after the lower hooks have been adjusted does not elevate the organs to any practical extent.

Extensive experience on the part of a corsetière with the making of this corset is not essential for delivering satisfaction from it. My experience has been that anyone who is capable of making a proper-fitting, made-to-order corset suffices. All that is necessary is to put into the front of this loosely thoraxed corset, instead of the straight steels that are ordinarily used, stays that have been properly bent in depth of concavity according to the case. This bending of the steels is usually accomplished by first detempering them by heat, and then setting them, when still hot, between three uprights set on a base (nails on a small board) so as to give the proper double curvature. An extra rotary twist along the axis will make it fit above and below flatter. For the best results I would advise the use of three degrees of curvature—slight, moderate and marked. These, with the simple, straight steels for corsets for stout women will serve in every case. The physician should advise just what degree of curvature the steels should be, rather than leave this to the corset maker. This matter is judged by a general observation of the size and shape of the abdomen, a consideration of how much curving is necessary to elevate the organs, and X-ray observations with the garment on to see that the necessary degree of uplift is being brought about. If this should not be sufficient, still deeper steels can easily be put into the garment until this essential point is satisfactorily accomplished.

Among the features in the construction of this corset that the maker must keep in mind are: that it is short behind at the top and low in front at the bottom; that it fits the wearer tightly around the

pelvis from the crests of the ilia down and decreasing gradually in pressure to the upper edge (with the corset properly laced the garment should be loose enough so that both hands may go down inside of the garment to the navel); that it is considerably incurved at the waist line at the back and sides, but shows no waist curve in front; that the front has as many long steels as possible and that these are uniform in shape but deepest in the center; that with corsets laced in front the lacing from the navel down to the lower edge be tight while that above the navel be loose as possible (two laces required); and that deep diaphragmatic breathing be possible without the corset above the iliac crests pressing upon the body.

HYDROPATHIC AND THERMIC TREATMENTS.

By these are meant the measures of external application of water of various temperatures and dry heat or cold for the treatment of digestive disturbances. Of these, for the purpose of relieving pain and inflammation, the time-honored Priessnitz Umschlag, or wet pack, is the most useful of measures. I have often used it with success in persistent gastric distress, accompanied with extreme nervousness. In my own experience when methodically kept up it is a very useful application in controlling the pain of acute gastric ulcer—in fact I may say the best form of external application in these cases that we have.

The technique of it is very simple, and many times it can be carried out in cases without the assistance of a trained nurse. A folded, small-sized sheet or towel is soaked in cold water and wrung out so that it does not drip. This is wrapped smoothly around the body, is covered by a sufficiently wide piece of oiled silk, or other impervious cloth, over which is bound another sheet or towel to keep it securely applied to the body. It is important, to prevent the bed-clothes and those of the patient from becoming wet, uncomfortable, and therefore dangerous, that the oiled silk or cloth used for the purpose be wide enough to extend well over the edges of the wet towel. It is not necessary to change this dressing often, usually not more than two or three times in the twenty-four hours. The inside cloth as a rule remains wet from the local stimulation of the skin, and generally when it is taken off, it steams like a cloth which had been wrung out in quite hot water. This sweat bandage, as I am pleased to call it, has a sedative and anodyne effect sometimes almost as perfect as a small-sized dose of morphine and often lasting longer and of course less objectionable in every way.

Complete warm baths and warm packs are sometimes of value

to control nervous and muscular tension and restlessness. These, with the special hot sponge bath, are all most useful measures to induce sleep in many of the insomnias that are found present in gastric affections.

The cold douche or bath has an excellent tonic effect on the nervous system particularly when those treatments are preceded by a few minutes of active exercise. The addition of common salt to the water in the proportion of from 9 to 14 pounds of sea salt to 50 gallons of water is additionally exhilarating and is the best form of cold bathing in those whose neurotic disturbance of the vasomotor

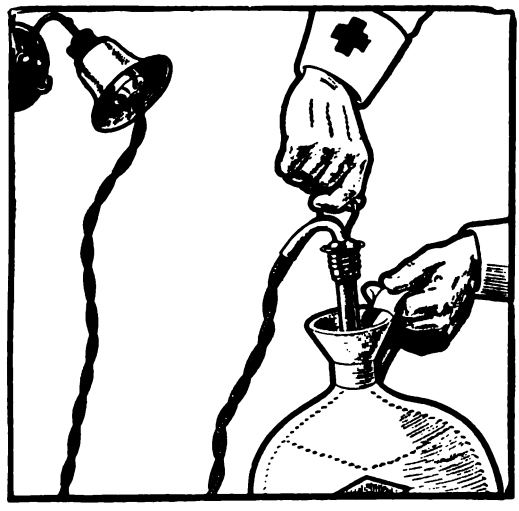


Fig. 70.—Water-bottle heater.

system prevents proper reaction from the plain water. The morning salt rub is also of value in poorly nourished cases. Naturally, such special hydropathic treatments as the Scottish douche, etc., cannot be carried out in hospitals or homes. They are of much value in the treatment of the more general neurotic conditions, and in digestive disturbances which are secondary to them. In cases of this kind, a length of sojourn in a well-ordered sanitarium, where these treatments, stricter hygiene, better air, etc., are readily at hand offers good service to many patients. Still, some of these hydropathic measures can easily be carried out at home, mornings or nights, in those cases which are up and about during the day.

Important aids also are the forms of hot application for the relief of acute pain. Of these, the poultices of linseed are sometimes

worthy of a trial, but my preference, for sanitary reasons and comfort to the patient, is the folded wet towel with the hot water bag over it. When the weight of the bag (which should never be more than one-third filled) is uncomfortable, and when we wish a prolonged action from the moist heat, of much convenience is the electric water heater. With it, a small quantity of water in a bag can be kept at an even temperature of about 135° F. These heaters usually work equally well on both the direct and alternating currents, and are inexpensive to run.

According to Fleischer and Penzoldt, the application of local heat to the gastric region hastens the emptying of the stomach, and this, of course, is a valuable state of affairs when we wish to control the total time of disturbed sensation of pain and secretion. I am inclined to believe, with Puschkin, that the application of heat favors increased hydrochloric acid secretion. On two occasions when treating acute gastric ulcers, the recourse from the ice bag to the poultice increased the burning following the taking of fluid foods, but not the actual pain in the stomach. In some of those resisting and also in bad cases of acute ulcer in which we are employing rectal feedings to save the stomach, the cold applications or the sweat bandage are the better procedure. This is so because rectal feedings reflexly stimulate gastric juice secretion, and these added to the direct stimulation of heat, when there is no food or alkalies present in the stomach to neutralize this free acidity, may somewhat retard the healing and increase the gastric symptoms.

Special forms of poultices, such as starch, bread and milk, yeast, etc., possess no added advantages over the simpler methods. Mustard plasters over the stomach are often of signal service to quickly control the symptom of vomiting in acute cases providing this symptom is direct from some condition of the stomach. The turpentine stupes are not of much value in the acute gastric distentions with gas. In the intestinal flatus, particularly of the colon, they are of benefit. When it seems permissible, a drop or two of refined spirits of turpentine swallowed on sugar may be used in a gastric condition, or a dram or more in hot water delivered into the colon will stimulate more motility in and evacuation from the bowels than the same substance applied externally.

Ice bags or quickly changed compresses, are of service in the control of pains, hypermotility, hypersensation and secretion. It is often impossible to foretell which of the two thermic measures, cold or warm, will answer best in the way of comfort to the patient. They both bring about the same results, but in different ways; one by con-

tracting the superficial vessels, the other by dilating them. When there is no special contra-indication to the use of one of them, a few hours experimenting will generally prove which would be of the most service.

In cases of distress or pain in the stomach for whatever reason, the use of live steam as an external application offers one of the best routine therapeutic measures for their relief. For this purpose I use

Fig. 71.—Kommerell steam pot with author's insulated handle. The cover of the pot is securely held down by the bar and screw. At the left of the cover is seen the cock for turning the steam into the pipe and handle. To the right is seen a safety-valve. The handle consists of an inner metal tubing capped by a blunt head, in the center of which is a small opening. Around the tubing is an air-space and then the insulated substance, which does not get hot during the passing of steam. The small points seen on the handle are metal tacks to give the hand a better purchase.

a Kommeral pot with an insulated handle in preference to other devices. The best form of treatment is to have an attendant apply the steam by holding the end of the handle about four inches from the body, the application not begun until sufficient steam has accumulated in the vessel to escape from the safety-valve. A towel should be used on the patient's legs and feet protected against the drip from the handle. The application is continued over the gastric region, axilla and back until the skin is red, after which a towel soaked in cold water

or a cold needle spray is applied for a moment or two. These are again repeated until about ten minutes have been consumed in the treatment. Such applications may be made once or twice a day until relief is established.

ACTIVE EXERCISE AND OTHER HYGIENIC MEASURES.

From a curative as well as a prophylactic standpoint against return in many of the gastro-enterological affections that are seen, are observances of the simple matters of hygiene and mode of regular régime. To those who live in country districts, blessed as they are with a life truer to nature than our city denizens, such advice is not so often essential or necessary. But they are important to those living in our great cosmopolitan centers, artificial as such a life must necessarily be in the way of constant application of the mind to matters of business, the small amounts of proper outdoor exercise, many social functions and eating of heavy foods late nights, poorly ventilated apartments, the hasty eating of day meals, and the intemperate use of alcoholic drinks, coffee, tea, etc., all of which have a direct bearing on the causation of many gastric disorders.

Along these lines it may be said that the daily use of the muscles in work, outdoor games, or gymnastics, serve as an aid to more complete metabolism and digestion. In the sedentary indoor avocations, regular physical exercise is an all-important requirement. Morning dumb-bell or weight exercising for five or ten minutes followed by a cold sponge steadily carried on as well as brisk walking evenings demands but little outlay of time for those who are steadily engaged. My advice has often been the purchasing of a cheap dumb-bell manual, and the performance of all of the twenty or more movements daily. On holidays, the resort to golfing, rowing or long country walks are diverting and health giving. Tennis only sporadically engaged in is much too strenuous for the ordinary city individual, although with the average woman player, who engages less actively, this is not so to the extent that it is with men. Automobiling and yachting are not as valuable as the more active sports.

Care must be taken on the other hand in those neurasthenic, atonic, and asthenic conditions, that over indulgence is not engaged in, because the resulting physical exhaustion often causes impaired digestion for the time being. In the atonic states of the gastro-enteron and abdominal walls, the simple constipations, etc., the forms of exercise which bring actively into play the trunk and abdominal muscles are of value.

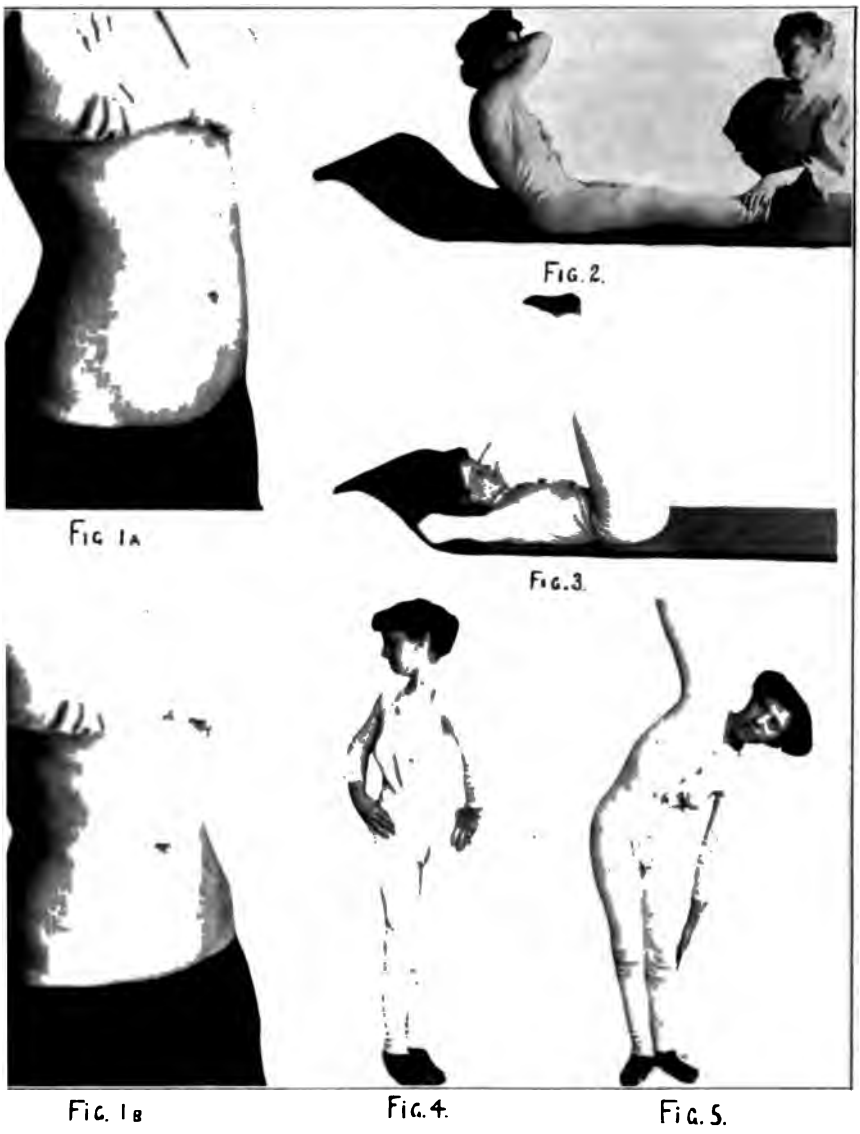
Where there is persistent anorexia (not due to organic disease), high loss of albumin in the feces, improper or incomplete conversion (indicanuria and associated and resulting general conditions), poor oxidation and assimilation of foods, disturbances of katabolism, and neurotic circulatory conditions, all of these are improved by exercise, fresh air and change. The manually hard-worked husband and the mother of the home often require rest, fresh air, and diversion, while their languishing late-breakfasting brothers and sisters in gilded residences require the same, with active exercise in addition. Lower temperatures in living rooms in the winter, fewer gas stoves and illuminating jets in the homes of the middle classes, better ventilated sleeping rooms in those of the poor, more open windows during the night, and the general health of city people would be better, neurotic disturbances less common, and gastric disorders fewer.

In cases of visceral prolapse most excellent results in the curative way have come from systematic carrying on of abdominal exercises. Naturally it must be expected that but little benefit could be gained by only a short course of treatment—say, of only a few weeks. Time and time again, I have observed these cases go on for months with apparently no definite benefit, when suddenly, almost in a day, some mysterious change takes place, in which the subjective symptoms fade quickly away. I do not believe that this is accomplished by the exercises alone, (high caloric feeding, support to the abdomen, attention in medical ways have much to do with it), but it must not be overlooked that in many of the instances of gastroptosis, nephroptosis, etc. in women who have not borne children and also in young men, there is poor power and control of the abdominal muscles. In the Landau cases one would almost expect it, relaxed and flabby as the parietes generally are.

The exercising not only develops their muscles to a marked degree, but patients gain an immense control over them. This causes their closer application to the functions of life, breathing, power in defecation, and equalizing the circulatory pressure of the abdominal cavity as a whole. The muscular walls soon thicken and strengthen, and this means better support to the organs within. The exercises have a beneficial effect on the organs in the way of toning them up by increased circulation. This not only helps them locally, but assists in the way of better function in the complex process of digestion, improving the general health of the abdomen and bringing about better vital conditions in the body.

When symptoms of digestive disturbance once ensue in cases of ptosis, they are liable to be more or less chronic in their nature

PLATE XXVI.



Abdominal exercises employed by the author.

and difficult to relieve permanently. Immediate relief of acute conditions are simply brought about, but how common are the cases which have run on with more or less distress in the digestive canal until they are taken in hand in the systematic way of steady attention. In accomplishing this the abdominal exercises are of the utmost value, and are really strong factors to complete and continued relief. They are also of value as prophylactic measures, carried on post-partum, to guard against the development of relaxed abdominal walls following pregnancies.

The system which I have advanced (Bassler[9]), and carry out generally in all of these cases consists essentially of five exercises. The first (Fig. 1) is a voluntary exercise performed by the patient. In this the patient directs her attention to her abdomen and endeavors to contract all of the muscles at the same time with the ultimate object of flattening all of the lower zone of the abdomen below the umbilicus. In most cases, in women particularly, this is somewhat difficult in the beginning, but when persisted in, eventually they gain perfect control of the muscles of this lower section. This tends to raise the organs within, and strengthens the wall in the part that usually bulges the most (permitting of descent), and is the most valuable of the group of exercises. For best results the movement should be slow, strong, and deliberate. The second (Fig. 2) is the raising of the body to a sitting position, the feet being held down or placed under a low piece of furniture, with the patient lying on the floor. The hands should be clasped in back of the neck so that the full brunt of the exercise falls upon the recti. The third (Fig. 3) is the raising of the lower extremities to a vertical position, or better still the toes be made to touch the floor above the shoulders. In this, when completely performed, all of the muscles are brought into play. Fig. 4 represents a twisting motion of the body, the feet and knees being together, and the hips held from turning. In this the three side muscles are exercised. The last movement (Fig. 5) is a rocking motion from side to side, the hands made to touch the leg below the knee, the feet are in contact with the floor, the knees together, and the elbows are held stiff.

These movements are performed mornings and evenings in as little clothing as possible. Each one separately is continued until just short of exhaustion from that particular one, when the next is begun. With the exception of the fourth and fifth, they can be carried out in bed. This makes them of service during late post-partum, and they are not detrimental to the end processes of uterine retraction in any way. After the person is about the standing exercises can be added.

References.

[1] Einhorn: Deutsche med. Wochenschrift, 1893.

[2] Meltzer: New York Medical Journal, June 15, 1895.

[3] Einhorn: Medical Record, May 9, 1891.

[4] Bassler: The Journal of the American Medical Association, May 2, 1908.

* Kny-Scherer Co.: New York City.

[5] Bassler: "Electric Massage of the Abdomen." American Medicine, Aug., 1908.

[6] Einhorn: "Diseases of the Stomach," fourth edition, p. 338.

[7] Bassler: "A New Corset for Gastroptosis." New York Medical Journal, July 18, 1908.

[8] Pfahler: Journal of the American Medical Association, December 21, 1907.

[9] Bassler: "Prophylactic Measures Guarding Against the Development of Landau Cases of Abdominal Ptosis." The Therapeutic Gazette, Sept. 15, 1907.

CHAPTER XIII.

Physical Methods of Treatment in Gastric Disorders.

(Continued.)

APPARATUS AND TECHNIQUE OF LAVAGE.

For the purpose of stomach lavage the syphon forms of apparatus answer best for general use. The ones ordinarily employed are the simple forms of long stomach-tube and funnel which possess the additional value of being readily procurable and convenient to carry about.

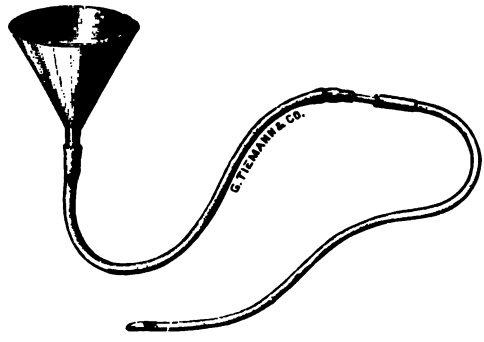


Fig. 72.—Lavage apparatus.

The funnel that is commonly supplied with the above and Friedlieb's apparatus is rather small, and being made of collapsible rubber soon flattens in shape. For these reasons it is better to use a glass or hard rubber funnel of about 250 cubic centimeters capacity, a glass one having the preference in that when the funnel is raised over the head the rate of flow of its contents can be observed. After the tube is introduced, the funnel is held slightly above the level of the stomach and the lavage solution poured in from a pitcher until between 250 and 500 cubic centimeters have been delivered. When the flow hesitates the funnel should be raised until this is re-established, at which it is immediately lowered again so that only a gentle inflow takes place. With a funnel of the common size about three funnels full is a safe amount to deliver at one time. Just before the last few cubic centi-

meters of fluid are about to leave the funnel it is quickly lowered to a basin on the floor, after which syphonage from the organ takes place. With successive elevations and lowerings of the funnel the stomach may be cleansed, which is noted when clear water runs off.

Besides the simple form of syphon stomach tube apparatus mentioned above, one may make use of the one which has a rubber ball about half way from end to end. This is practically the Friedlieb apparatus and possesses the additional value of having handy an accessory means to insure success in the procedure. When the return flow stops, as often happens from kinking of the tube in the stomach, non-immersion, or obstruction of the apertures by food, after first pinching the tube on the distal side the compression of the bulb will correct these so that the flow will be re-established.

Fig. 73.—Syphon stomach-tube (Friedlieb's apparatus).

The objections to the above forms of apparatus are that a second person is required to manipulate the tube and pour the solution, and in those who are not accustomed to the tube that the procedure is liable to be performed with difficulty in the way of keeping the tube properly *in situ*, or that the patient's garments and the floor are soiled with the solution. When lavage is being regularly carried on with a single patient or with a number of persons in a hospital or clinic the Leube-Rosenthal method not only eliminates some of the above objections but is much handier.

This method depends upon the use of a jar or bag for the purpose of holding the solution, and a Y-tube with pinch cocks to regulate the flow either into the stomach or from it. With the cock on outlet tube of the jar closed, the irrigating jar or fountain bag is filled with solution and the detached stomach tube is then passed and the outer end fastened to one arm of the Y-tube. By closing the cock on tube *c* and opening the one on tube *a* the solution runs into the stomach, and when sufficient fluid has been delivered the lower cock is opened and

the upper one closed. In the return of the fluid it is better to open the lower cock before the upper is closed, because in the moment that both of them are open the solution from the jar, running directly to the basin below, initiates a syphonage through the stomach-tube which continues after cock *a* is closed and until the organ is empty. A second person is not required to manipulate this apparatus (I have had patients who could manipulate the cocks themselves) and the

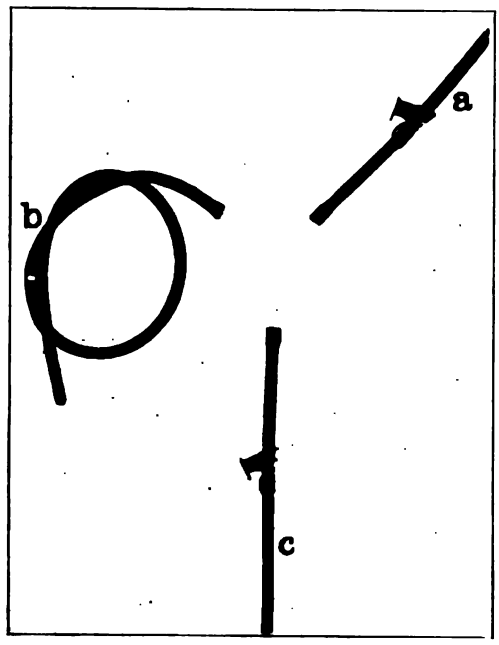


Fig. 74.—Leube-Rosenthal method of gastric lavage. *a*, Tube leading from the irrigator jar to the glass Y. *b*, Stomach-tube. *c*, Drainage-tube leading to basin on the floor.

advantages of this method are many to the more commonly used hand apparatus. In the first place the attendant with one hand can control the cocks by standing at the side or rear of the patient, while the other arm is about the neck of the person and the hand of which is holding the stomach-tube in place or manipulating it in and out as may be required.

By having a stand holding two jars side by side, two solutions can be used in the lavage, one for the purpose of cleansing the stomach such as an alkaline solution of soda bicarbonate or lime water, and the other for the special medicaments such as silver nitrate, hydrastis,

or the antiseptic solutions. A four-armed glass communicating tube may be used with all tubes attached at the same time, or with the Y; the outlet tube from one jar can be taken off when the first jar is empty and that from the second attached.

Experience has taught me that it is wisest to use graduated glass irrigating jars or large bottles with an outlet near the bottom. In the double stand I employ, the first jar has a 3000 cubic centimeter capacity and the treatment jar a 1000 cubic centimeter. In the average case at least 2000 cubic centimeters of solution are necessary to cleanse the stomach, and 3000 is usually solution enough to make sure of this. More solution can easily be added to the jar if the return is not clear from 3000 cubic centimeters, and less than the total contents of the jar may answer. Not more than between 250

Fig. 75.—Chase apparatus.

and 500 cubic centimeters should be run in at a time, and note should be made that the effluence corresponds to the affluence. For cleansing the stomach it is desirable that the affluence should occur just below the cardia, and when the effluence is desired the tube be pushed further down until the return takes place.

Occasionally it is advisable for patients in whom a course of lavage treatment is indicated and who have become accustomed to the use of the tube, that the home employment of some form of apparatus be advised which is possible of manipulation by the same person. In these instances I have found that the Chase apparatus answers to good purpose, both for the alkaline lavage and for special solutions. To employ it, the solution is placed in a large basin before the patient, and by means of the hand ball submerged into it and the pinching of the tube while the ball is being filled and then releasing the pressure on the tube and placing the thumb in the inlet the solution is driven into the stomach. After three or four bulbfuls have been delivered the

solution is drained off into a vessel on the floor. A second basin may be used for special solutions.

The so-called Gastromundator may be used instead of the above, but it is more difficult to clean. In this apparatus the in and out flow is controlled by changing the position of the bulb. These apparatuses answer well for the small amounts of solution that are used for the purpose of examining the contents of the empty stomach, such as detached gastric cells, pus, blood, tissue and food particles, etc.

For the purpose of straining the return wash water from the stomach the author recommends the use of the sieving pail shown on next

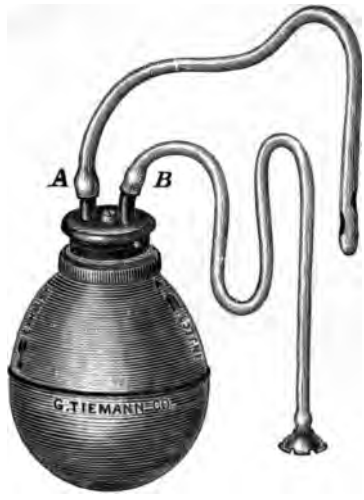


Fig. 76.—Gastromundator. By merely turning the ball the valves change position, so that, without being obliged to disconnect the tube, the stomach may be first filled and then, by merely turning the ball to the opposite arrow, emptied, and so on *ad infinitum*.

page. Among the particles, the noting of which are of value in the diagnostic and therapeutic way, are pieces of tissue from the gastric glandularis, food of the various solid kinds, and mucus. In large amounts of water, tissue particles, because of their small size, being mostly colorless, and few in number, are very liable to escape detection unless collected. Most often they occur as very small flaky pieces, too tiny for recognition, and they may be incorporated in mucus and then not be seen. Their significance being great, they should be examined microscopically and if large enough by the microscope after dehydration, hardening, cutting and staining.

The recognition of states of delayed motility and dynamic obstruction at the exit of the organ is best made by observing the

time it takes for the various kinds of foods to leave the stomach. The universally employed procedure of observing whether stenosis exists by washing out the morning stomach after a heavy meal ingested the night before, and the six, seven, eight, and so on hour extractions of the mixed meal for the purpose of diagnosing the existence and degrees of submotility makes the use of the sieving-pail of value in the technique of lavage. To the above may be mentioned the fact

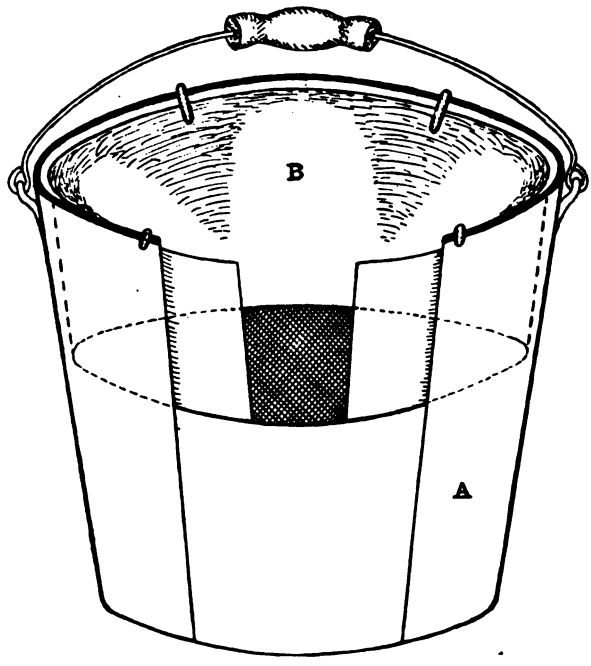


Fig. 77.—Author's sieving pail for straining lavage water. *A*, Ten liter pail. *B*, Portable sieving can with a floor of wire screening having sixty wires to the inch, and four hooks above to hold the can in place.

that even in the hands of skillful manipulation, particles of tissue detached from the stomach in the process of lavage are not infrequently met with and thus I advise its use on all occasions of lavage. Bassler.[1]

The apparatus is very simple, consisting merely of an ordinary enameled ware 10-liter pail, into which is fitted a straining can which is made to set snugly into the upper part. The can is made of metal (preferably brass or tinned sheet iron) with hooks above to hold it in place. The floor consists of a brass wire mesh having 80 wires to the inch. This screen stretches across the pail at about one-third the

distance from the rim to the bottom, and is of strong enough texture so that it will stand handling without breakage. This apparatus can be made up less expensively by using an ordinary pudding pan large enough so that its flange will set on the top of an ordinary pail or jar. The mesh is of the kind that is supplied on sieves that are used for sifting grain, sand, etc. At the end of the lavage the can is taken out and the mesh surface inspected, after which it is cleaned by allowing water to run through it from the under side.

INDICATIONS AND SOLUTIONS. CONTRA-INDICATIONS.

The indications for lavage are diagnostic and therapeutic. The matter pertaining to the diagnostic will be found in the description of the different test-meals and their examination in Chapter VI, and the therapeutic in connection with the various stomach disorders. A brief résumé of the latter might not be amiss in this connection and may serve to some practical purpose on this very valuable and still much abused therapeutic measure.

Therapeutically, lavage of the stomach is indicated when some definite reason for its employment exists, either in the way of the removal of irritating and decomposing foods and their products and bacteria, or the treatment of the organ for some manifest condition—not just because the patient is a "dyspeptic." In the first group may be mentioned the cases of pyloric or high enteric obstruction of all forms, the removal of decomposing foods in states of fermentation such as are seen in the butyric acid type of chronic gastritis and the lactic acid type of malignant disease, for the quick removal of swallowed poisons, and intestinal regurgitations such as occurs in ileus. High degrees of dilatation secondary to obstruction (in so far as the relief for the condition is concerned) are surgical cases although relieved by lavage. Primary atonies and duodenal kinking are medical in the way of special dietetics and all medical measures excepting lavage in the great majority of cases.

As a procedure of special treatment in addition to the above, lavage is of signal service in many of the gastric disorders. In chronic gastritis when an increased secretion of mucus is present, the procedure liquefies and removes the adherent mucus and stimulates the glandularis to a higher acid—enzymotic secretion. In this way the motor mechanism of the organ is toned to a more active pitch and the condition of gastric digestion generally improved. For these results in addition to the stimulating effects of the water itself the alkalies (soda bicarbonate 4 tablespoonfuls to 3000 cubic centimeters,

or lime water 90 cubic centimeters to 3000 cubic centimeters) answer best. After the use of the alkaline solution, a solution of the fluid tincture of hydrastis (15 cubic centimeters to 1000) or the fluid extract (4 to 8 cubic centimeters to 1000) prevents the excess mucus secretion better than any other measure. Late in the treatment should the normal hydrochloric acid secretion be low, pure hydrochloric acid (6 cubic centimeters to 1000) may stimulate a higher secretion and is the most efficient antiseptic to employ. In chronic gastritis when all of the stomach digestive secretions are absent and even if mucus be present in the organ, no benefit comes from the use of lavage as a stimulant; the reason of this is because the gastric cells are so altered by pathological process, or even shed from the tubercles and lost, that but little can be expected from lavage, and thus the dietetic, medicinal, and hygienic measures answer best in the treatment.

In low gastric juice secretions (hyposecretion which is usually accompanied with hypomotility when not organic or malignant in nature) the hydrochloric acid, sodium chloride (5 to 2000) and 1 to 1000 silver nitrate solution may, for a short time, serve as an efficient stimulant to the mucosa. Proper dieting to meet the digestive capacity and still represent a caloric value beyond the requirements of the individual's daily demand (so that the patient can overcome the subnutrition that usually exists) with local and general tonics and hygienic measures answer best for the more permanent relief. In excess gastric juice secretions (hypersecretion, which may be accompanied with hypermotility, and in gastrosuccorrhea) harm is done by lavage. To this, however, in practice there are two notable exceptions. The first is in those in whom an excess acid secretion exists and but little or no gastric mucus is present. These cases, and they are common, receive subjective relief of the gastric distress by the employment of the silver nitrate solution. It acts as an irritating stimulant to the epithelia of the stomach and as the mucus content raises, even when the HCl secretion remains the same or increases from its use, subjective benefit is acquired. In a large number of these cases I extracted test-meals and aspirated the empty organ during the treatment to note in what manner this benefit was brought about. Excepting the mucus factor mentioned above, and the removal by the lavage of such gastric juice that exists in the organ without food to bind it, I think that in those who were permanently benefited this was due to an induced catarrhal process in the upper cells of the gastric tubules from the silver nitrate solution thereby depriving certain cells of their full or partial secreting function. On the other hand are seen cases, and they comprise the majority,

in which the HCl secretion always remains high and even increases from the use of the solution, and these are the ones that usually return in a few months for a new course of treatment when only the silver solution lavage had been used in the first instance. With them it is generally observed that the gastric finding of low or absent mucus have returned as it was in the first analysis. Therefore it is that the constant use of bland and unirritating foods as low in the proteids as inconsistent with proper nutrition, the hygienic measures, and more normal mental routine of life in the way of business, home and associations, answer to the best results in the end. The second exception is that of the irritative form of gastritis known as gastritis acida. In these the use of the alkaline lavage solutions, together with the dietetic and other indicated measures answer to good purpose. Care, however, must be exercised that the lavagings are stopped when the mucus content is controlled, which I may mention is very variable in each instance and usually most liable to return unless the person stringently adheres to the other special treatments.

Lavage of silver nitrate solution may answer to good purpose in chronic ulcer particularly when more or less stenosis of the pyloric extremity causing retention exists; although here surgery offers the more lasting and satisfying results. It is of signal service in post-operative dilatations of the stomach in the way of removing the large quantities of irritating fluid that usually collect in the organ and also as a muscular stimulant; in these instances the alkaline or the same with tincture of nux vomica dissolved in rather warmer water than is ordinarily employed are of the most service. As a procedure lavage is often of value in the treatment of such symptoms of gastric distress as anorexia, pain, nausea and vomiting, and in these instances the alkaline or normal sodium chloride solution answers well. It is also frequently successfully employed in disturbances of function and diseases of the intestine and of the liver, in conditions of abnormal blood mixture, and in the chronic states of intoxications from renal disease—for example in uremia; in these plain warm water or the alkaline lavage answers. In the routine lavage the solution should always be comfortably warm to the hand, remembering that several degrees of cooling takes place in the pouring and in the passage of the fluid through the tube.

Among the contra-indications for lavage are those for the use of the tube which will be found described in Chapter V. To these may be added the few instances in which the attendant distress is too severe on the individual, and those who from the extraction of body heat, or when the lavage is practiced during the day from the extrac-

tion of foods and the cessation of digestion, become weak and prostrated after its performance. Gastric lavage at an improper time is much more exhausting than when the stomach is empty. Therefore as the morning stomach before food has been taken, in addition to the organ being positively empty, is also the best time because the vitality is higher and the nervous system is calmer after the night's rest, and because the lavage then cleanses the organ for a day of better digestion. Evening lavage, however, may be practiced in instances of stagnation of food. In these cases the cleansing of the organ before retiring often makes possible a better night's rest. Both morning and evening lavage is usually inadvisable because the patients soon lose strength from extraction of fluid, nourishment and body heat, and if persisted in long enough may be the cause of high degrees of exhaustion.

Excepting in cases in which the diagnosis of an ulcerating carcinoma, old ulcers of the stomach, or that of spasmed closure of the pylorus are most probable, the return of more or less bright blood in the water is a contra-indication for the continuation of the washing. In the above mentioned exceptions the blood is usually more or less altered and even in clots of a bright color. In unexpectedly met with bright blood the tube should immediately be withdrawn because the hemorrhage is usually due to trauma on capillary congestive states of the mucosa, varix in the esophagus or stomach, or the existence of an unsuspected ulcer. Lastly, it may be mentioned that Ewald recommends the use of ice-water lavage when slight hemorrhage exists even if this is from an ulcer. Lavage with a solution of copper sulphate (3 to 1000) is specific in instances of the green fungus and pellicle in the stomach.

GASTRIC DOUCHE. SPRAYING AND INSTILLATIONS.

The gastric douche is used for the purpose of therapeutically influencing the gastric mucous membrane. Its efficiency as a procedure depends less upon the style of douche tube that is used than it does upon the character of the solution and the pressure under which the water is delivered. Although the ordinary Ewald tube which is used for both simple lavage and douching answers well for douching in a few instances, a higher pressure can more safely and conveniently be exerted by tubes which have only small sized apertures at the outlet. The Ewald tube, and the douche tubes of Rosenheim and Einhorn (page 107) possess the disadvantage that the outlet and return of the water takes place from the lower end. Thus

to a great extent by the patient sitting on rather a high stool and having a length of outside tubing to the floor so that a strong syphonage force is exerted. Even with this, however, it is usually desirable to stop the inflow at times and allow the outlet tube to empty the organ. In my experience with this tube it is best to introduce it fully into the stomach, then turn on the inflow and withdraw the tube quickly until the end of the inlet section is in the gullet (noted by the inflow being much controlled or possibly stopped altogether). The tube is then slowly reintroduced until a good flow begins, and held at that level until the procedure is terminated.

It is true that for rather constant therapeutic use the douching tubes have but little advantage over the lavage tubes of Ewald or Boas. But in selected cases of hypomotility, in slight atonies, and

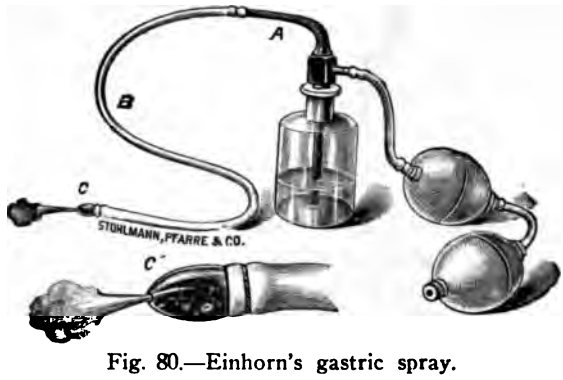


Fig. 80.—Einhorn's gastric spray.

hyposecretion the douche tube can bring about stimulating results to the organ and thus for these cases their use should be retained after the prior cleansing wash can be discontinued. In addition to the solutions mentioned above there may be used pure Vichy or Vals spring water in the acid form of gastritis, and in the low secretory and motor conditions, quassia amara (50 grammes in a liter of cold water, macerated for twelve hours, and filtered), or fluid extract of condurango 10 cubic centimeters to a liter of water. It is obvious that the organ must always be empty at these treatments.

Spraying without the return of the introduced solution can be practiced with the Einhorn spray. The advantages of the spray are that it is quickly performed, that together with the spray, air in sufficient quantities to balloon the organ (so that the solution can come in contact with the mucosa) is introduced at the same time, and that with the use of nitrate of silver solutions the drug in aqueous

solution can be delivered directly into the stomach. When the instillation of a small quantity of a strong silver nitrate solution is desirable it is best done so by the spray for the reasons that its conversion into silver chloride solution, from contact with the chloride salts met with when the nitrate salt is swallowed into the stomach, does not take place, and also to obviate the disagreeable features of the metallic taste, puckering sensations in the mouth, and staining of the lips. The tube is introduced to a distance of about 45 centimeters from the lips of the patient, and the spraying commenced. As the tube is being pushed farther down half a dozen or more pressures upon the bulb should be exerted until the tube had been introduced about 20 centimeters farther. The use of this method of treatment is of value in the superficial catarrhal ulcers of chronic gastritis, and as a stimulant to higher mucus secretion in cases of hypersecretion. The use of silver nitrate is of no service as stimulant to higher gastric juice secretion, or as an astringent to control high states of secretion. A 2 to 4-per-cent. solution of silver nitrate may be used, care being taken not to deliver more than 0.2 gramme of the silver salt at one time. At the spraying the stomach must not only be empty but should first be cleansed by lavage to remove the mucus, adherent food particles, free gastric juice, and bacteria. This requires the passage of two tubes, one for the lavage and the second the spray tube, and consequently it is that one is usually inclined to use a 2:1000 silver solution in the regular lavage way following the washing solution in preference to the single employment of the spray. In my own practice, I have limited the employment of the Einhorn spray with silver solution to a short period in the late treatment of acute gastric ulcer when I believe it to be inadvisable to employ lavage and I wish to stimulate the process of healing. But as soon as the patient is up and about, I much prefer the therapeutic use of the X-ray for the same purpose, because the results are quicker and more definite in each instance. In several cases of chronic ulcer I have used the silver nitrate spray with no appreciable results, operation being necessary in each instance.

Other instillations and methods have been used in gastro-therapeutics. Among these may be mentioned particularly the use of one of the bismuth salts poured down through the tube after the organ has been cleansed. For this purpose 10 to 20 grammes of bismuth subnitrate to 200 cubic centimeters of water can be used, after which the patient lies for a few moments in different positions so as to coat the stomach interior. I have found this form of treatment of service in cases of persistent excess secretion and particularly in late acute

gastric ulcer, and in the irritative motor phenomena of peristaltic unrest and spasm of the pylorus. In excess secretions when slight atony also exists and but little or no mucus is present (gastro-succorrhea of long standing) I have obtained some good results from the use of an alkaline lavage before breakfast and the instillation of 10 to 20 grammes of bismuth subcarbonate in 100 cubic centimeters of a good quality olive oil. When the pylorus is patent and no gastric dilatation exists the taking of a glass or two of the alkaline or the alkaline sodium sulphate waters (which washes the stomach into the intestines) and the drinking of the above mentioned instillations answers for the average case of excess secretion that is seen, or the home treatment of a patient after a course of lavage treatment.

Einhorn[2] has advanced a powder-blowing apparatus for the insufflation of insoluble substances, the value of which has yet to be proven. It occurs to me that these substances, such as the bismuth salts, orthoform, protargal, powdered suprarenal gland, etc., can be given in just as effective a way and much more pleasantly by the drinking of these substances in suspension menstrum, or in soft elastic capsules.

KUSSMAUL PUMP. GYROMELE.

It is to the everlasting credit of Kussmaul to have conceived the idea and have had the courage to apply the first instrument for direct gastric work. The form of apparatus was a pump, which according to Bowditch's reports (1852) was used by the American physician Wyman for the purpose of draining empyemata. To this he added a long, stiff, aspirating tube, and evacuated the stomach contents of a young girl who had long been a sufferer from gastric stagnation, which condition followed a cicatricial pyloric stenosis from gastric ulcer. Although this memorable event occurred on July 22, 1867, Kussmaul's report of the case is so full of classical medical observation and results from special therapy that it is worth repeating his conclusions as he gave them. The patient was a country girl, from Heimbach, aged 25, named Marie Weiner. She had been suffering from almost daily gastric pain and vomiting for fourteen years, and required the constant administration of morphine to relieve her and assure sleep.

"Quite frequently, when I observed the patient in the miserable prodromal stage of vomiting, the thought had occurred to me that I might ameliorate her sufferings by the employment of the stomach-pump, as the removal of large masses of decomposed gastric contents should cause the agonizing burning and retching at once to cease. The introduction of the esophageal sound was naturally not difficult, for where a gastric dilatation has existed for so long a time the esophagus

also is usually dilated. The artificial emptying of the stomach by the pump could be no more painful or distressing than her condition before and during vomiting. At all events, it would be more rapid and complete than the natural emptying of the stomach by the act of vomiting, with its prolonged prodromal stage of nausea, pain and retching. Repeatedly, even after vomiting, palpation and percussion revealed that the stomach still contained considerable masses. This condition reminded me of the so-called ischuria paradoxa, in which large amounts of urine flow daily from the dilated urinary bladder without its actually becoming empty and without reducing completely, and, if its elastic and contractile powers have not been entirely exhausted, perhaps even give to it the tone to contract to its smallest extent, just as the catheter occasionally brings about recovery in ischuria paradoxa.

"In our patient the gastric dilatation was due to constriction of the pylorus. At the autopsy of cases of extreme gastric dilatation I had repeatedly observed that the stenosis which caused them would still permit the passage of a small finger from the stomach into the duodenum, although toward the end of life there had appeared to be complete closure of the pylorus. In such cases I had occasionally noted at the bedside through the abdominal covers active movement in the stomach A paresis of the gastric musculature might be present, but certainly not complete paralysis. It appeared to me as though the excessive distention, the filling and overloading of the stomach itself, produced a mechanical action which increased the constriction of the pylorus to complete closure, and this condition I hoped to remove by emptying the stomach and decreasing its size.

"Finally it appeared that the employment of the stomach-pump would permit a more active topical treatment of the diseased gastric mucous membrane than was formerly possible. In the case of our patient this organ had for years been continuously irritated by extremely acid contents. The retention, stagnation, and decomposition of masses of food in the stomach because of pyloric stenosis is certainly often the only cause of the catarrh of the mucous membrane; as, for example, in cases in which originally there was but an ulcer or a cicatrix of the pylorus the stomach being otherwise intact; in all other cases it probably maintains and increases a catarrh already present. This is probably why we note so constantly, in constriction of the pylorus, that the mucous membrane about the pylorus, where the gastric contents especially accumulate, shows most intense disease. The stomach-pump, I hoped, would not only make it possible completely to evacuate these acid, irritating masses, but would also permit the washing and cleansing of the diseased mucous membrane which had been irritated by acid and alkaline fluids, as, for instance, with Vichy water or with an artificial soda solution.

"The introduction of the stomach-tube, the pumping out, and the washing with Vichy water were unexpectedly easy. We withdrew three liters of acid, dirty gray, sarcina-containing fluid, with particles of food of all kinds undergoing softening and decomposition.

"Even the immediate result of the first emptying and washing of the stomach with Vichy water was a surprisingly beneficial one. The patient, who was previously always exceedingly disagreeable, and of such a whining disposition that she well bore out her name, 'Weiner' (crier), appeared a few hours later as if completely transformed. For the first time she was agreeable and appeared comfortable in her bed, and she declared that for years she had not been in such good spirits. She at once digested and slept much better, and for two days was entirely free from depressing sensations in the stomach. After repeating employment of the pump, at the end of fourteen days the patient had a more healthy appearance and had become

another being. She who had always been disagreeable, had lain in bed or reclined in an arm-chair, was up the whole day, was very friendly, and attempted to make herself useful about the room, and soon in other parts of the house. In the first three months of her stay in the hospital, and before the employment of the pump, she had gained at most about 5½ pounds in weight; two months afterwards she had gained at least 16½ pounds, and in not quite six months, 24 to 25 pounds. For two years recovery has been complete, although the patient is by no means in easy circumstances."

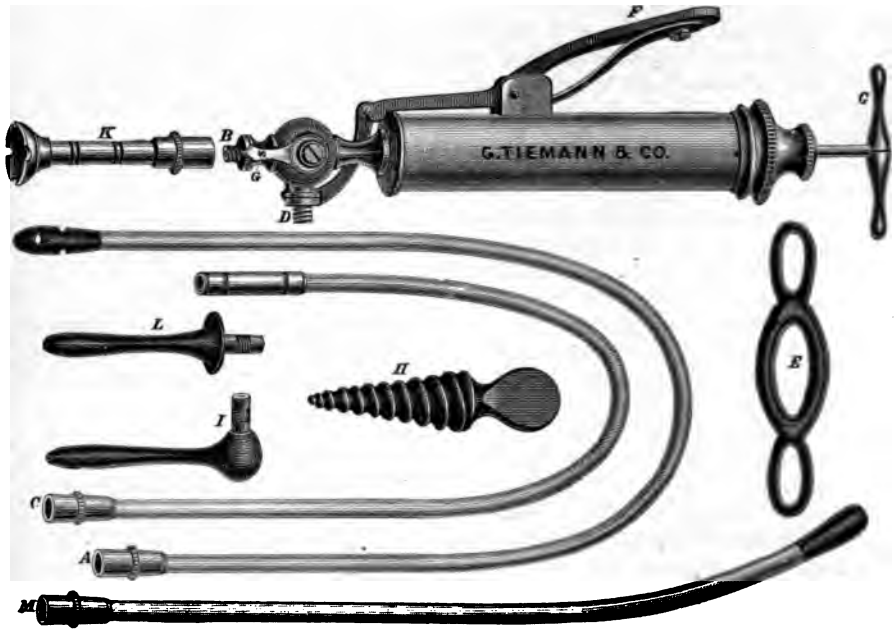


Fig. 81.—Kussmaul pump for rapid evacuation of stomach contents.

Following this Jürgensen improved upon the process of stomach evacuation by the substitution of a soft tube which was introduced by means of a whalebone staff. To obviate the danger of the use of a stiff tube, Ewald and Nothnagel, independently of each other, learned that a soft tube could be introduced without the help of a staff. The stomach tube of to-day, which was patented after the Nelaton catheter, was first employed by Leube, since which time it has come into general use.

For the purpose of gastric work the Kussmaul pump and the stiff forms of stomach tubes have only an historical interest. Even in poison cases in which a rapid and complete evacuation of the stomach would be desirable, the fact has become generally known that the simple tube (stiff enough to hold straight when held vertically about

20 centimeters from the end) and the funnel answers for all occasions, and is always safe to employ.

For the purpose of removing excessive amounts of mucus Turck has devised an instrument he called a gyromele. It consists of a stomach tube with an end sponge which is rotated by means of an outside disk device. I have never used the apparatus, feeling that results from the employment would be questionable, and fearing that the sponge with its metal stem might become detached in its use and be left in the stomach, or that the sight or manipulation of the instrument might alarm apprehensive patients. It occurs to one that mucus which is that firmly adhered to the mucosa that it requires powerful measures to remove it might better be left there. The gastric mucosa

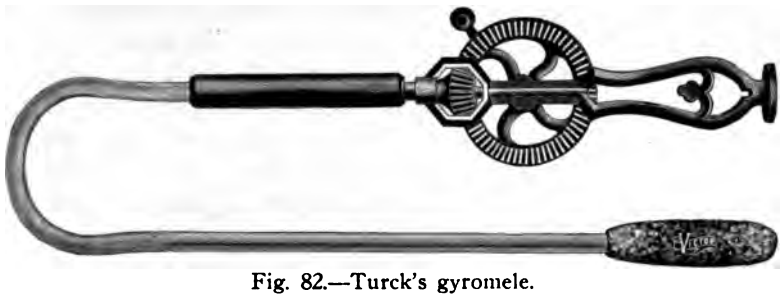


Fig. 82.—Turck's gyromele.

is very soft, pulpy, and delicate, and will stand but little pressure or rubbing without injury. Therefore, I feel that the mucus that would not be removed by the use of lavage with the alkaline solutions, particularly when the fluid is flowing from an elevation, had better remain in the organ. For after all, mucus in a sense is nature's method of protection, and it is only the free form incorporated with the food or the treatment of the condition which causes excessive mucus formation that concerns us therapeutically.

References.

[1] Bassler: "Sieving Pail for Lavage Water." Journal of American Medical Association, February 27, 1909.

[2] Einhorn: "Diseases of the Stomach." p. 172.

CHAPTER XIV.

Physical Methods of Treatment in Gastric Disorders.

(Continued.)

BALNEOTHERAPY.

At the onset of the consideration of this subject I wish to record my opinion that there is no special mineral water in existence, which, in virtue of its chemical constituents, possesses the power of creating a cure of any digestive, general, or katabolic condition or disease. Proof of this may easily be gained by the home use of the different waters in the cure of conditions for which their employment had been lauded by the various spas from which they came. In the many cases of digestive disorders I have treated in the past years, the instances of the use of the many highly recommended mineral waters constantly came up for consideration and were employed many times in the treatments. Beginning years ago with an ambition to apply them as far as possible, and doing so according to the apparent proper selection of a water for the case, I have finally come to the belief that the chase after the illusive and mysterious molecule of therapeutic worth in them is much on the wild goose order, and that such values as come from their use is due simply to the neutralizing effects on high secretions and dissolving of adherent mucus in gastritis by the alkaline types, the stimulating effects on low gastric secretion by the chlorine (muriated) and carbonic acid (acidulous) class, the purgative effects of the "bitter" waters in constipation, the simple tonic effects of the iron or chalybeate and the arsenical ones, and lastly, to the medicinal virtue that there is in the use of plain water itself as a necessary solvent, cleanser, and constituent of the body.

It is hardly fair to the general medical profession or concomitant with scientific medicine for spa authorities to ascribe curative results to the action of the waters of the springs in their possession, in the way that the drinking of these fluids has and can cure the various forms of digestive disorders, without their laying more stress than is done upon the fact that the remedial or beneficial effects of a sojourn at the spa is most largely dependent upon the associated conditions, such as alterations in diet, freedom from business and domestic

worries, climate and out-door life, exercise, social surroundings, etc. In so far as the patient is concerned, there is no doubt that these latter conditions can be more conveniently, regularly and successfully carried out at the spas, but in reports to physicians the mineral waters themselves must not be given the sole credit for many of the good results that are achieved.

While at home in many persons who are surrounded by depressing influences and unhygienic conditions, it is next to impossible to turn the routine of life about in a completely desired or continued way, and for these, when their means and time permit of it, the physician often expedites results or brings about a greater benefit by recommending a course of treatment at one of the spas. Quite logically on these occasions, it would serve to better purpose, if, in the selection of the place, one takes into consideration the main abnormal conditions of the case, and recommends a spa the waters of which in chemical make-up seem to meet one or more of the indications.

The better effects that are produced in the foreign spas compared to those of our own home country are derived, in my opinion, from the facts that the necessary trip across the ocean is a most healthy and quiet recreation on the first hand, free from business and home surroundings, and being always in the midst of strange, interesting, and companionable people; then comes the life at the spa, far removed from the home source; and lastly, the ocean trip back again—the entire vacation requiring at least five weeks' time. In the vastness of our country, the few spas of value that we have in which a general routine of treatment is religiously carried out are usually so far removed that it requires a long stuffy and fatiguing railroad journey to get to them and back again, and that the United States mail, telegraph lines, and fast express trains usually keep up more or less of a communication with the patient. Added to these, are the facts that the surroundings, people, quiet, and climate are not often so desirable as they are in those abroad—the waters themselves and the baths being as good.

Among the notable foreign spas in which the various types of waters are obtainable, and some of which can be procured here, are:—

ALKALINE WATERS.

Simple Alkaline With Free CO_2.

Vichy, France.
Vals, France.
Fachingen, Germany.
Bilin, Bohemia.
Passugg, Switzerland.
San Marco, Italy.
Borjom, Russia.

tion of foods and the cessation of digestion, become weak and prostrated after its performance. Gastric lavage at an improper time is much more exhausting than when the stomach is empty. Therefore as the morning stomach before food has been taken, in addition to the organ being positively empty, is also the best time because the vitality is higher and the nervous system is calmer after the night's rest, and because the lavage then cleanses the organ for a day of better digestion. Evening lavage, however, may be practiced in instances of stagnation of food. In these cases the cleansing of the organ before retiring often makes possible a better night's rest. Both morning and evening lavage is usually inadvisable because the patients soon lose strength from extraction of fluid, nourishment and body heat, and if persisted in long enough may be the cause of high degrees of exhaustion.

Excepting in cases in which the diagnosis of an ulcerating carcinoma, old ulcers of the stomach, or that of spasmed closure of the pylorus are most probable, the return of more or less bright blood in the water is a contra-indication for the continuation of the washing. In the above mentioned exceptions the blood is usually more or less altered and even in clots of a bright color. In unexpectedly met with bright blood the tube should immediately be withdrawn because the hemorrhage is usually due to trauma on capillary congestive states of the mucosa, varix in the esophagus or stomach, or the existence of an unsuspected ulcer. Lastly, it may be mentioned that Ewald recommends the use of ice-water lavage when slight hemorrhage exists even if this is from an ulcer. Lavage with a solution of copper sulphate (3 to 1000) is specific in instances of the green fungus and pellicle in the stomach.

GASTRIC DOUCHE. SPRAYING AND INSTILLATIONS.

The gastric douche is used for the purpose of therapeutically influencing the gastric mucous membrane. Its efficiency as a procedure depends less upon the style of douche tube that is used than it does upon the character of the solution and the pressure under which the water is delivered. Although the ordinary Ewald tube which is used for both simple lavage and douching answers well for douching in a few instances, a higher pressure can more safely and conveniently be exerted by tubes which have only small sized apertures at the outlet. The Ewald tube, and the douche tubes of Rosenheim and Einhorn (page 107) possess the disadvantage that the outlet and return of the water takes place from the lower end. Thus

in the process of douching it is essential first to withdraw the end of these tubes to just below the cardia, and after a certain amount of water has been delivered into the stomach, it is necessary to push the tube down to the collection of water and syphon it off before douching can again be carried on.

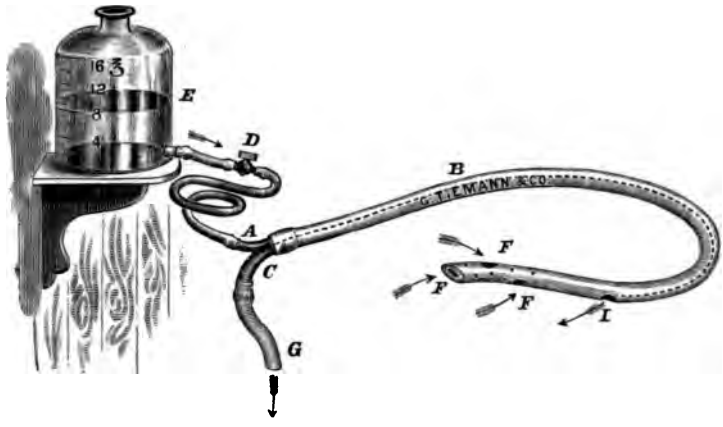


Fig. 78.—Hemmetter's double-current stomach lavage-tube.

The tube which Hemmeter has devised obviates to a certain extent the feature of water collection but can hardly be considered as a douche tube. It answers to better purpose for lavage, although for cleansing the organ, because of its relatively larger size, it is not superior to the single tubes. The double tubes are more difficult to keep clean, and the fact that when the pressure of influx is beyond the force of gravity on the outlet accumulation of water in the stomach generally occurs, and thus too large amounts of water for safety are very liable to accumulate, is another factor against their use.

Fig. 79.—Turck's recurrent gastric needle-spray or douche.

The tube that answers to the best purpose for simple douching is Turck's so-called recurrent gastric needle spray. With this tube the inlet can be held stationary below the cardia or in the fundus, while the return tube extracts the accumulation fluid from below. The objectionable feature during the douching of the accumulating of fluid in the organ (mentioned above) can with this tube be obviated

Alkaline and Common Salt Waters.

Royat (warm), France.
Ems Rock Spring, Victoria, Germany.
Apollinaris, Prussia.
Rhens, Germany.

Alkaline and Sodium Sulphate Waters.

Marienbad, Bohemia.
Carlsbad (warm springs), Germany.
Tarasp, Switzerland.

Among these, Vichy Celestins, Fachingen, Ems, Apollinaris, and Carlsbad Thermal Waters are good for home use.

CHLORINE WATERS.

(Containing mostly common salt.)

Ems Rock Spring, Victoria, Germany.
Wiesbaden, Kochbrunnen, Germany.
Homburg, Germany.
Kissingen, Rakoczy, Germany.
Selters (also alkaline), Germany.
Nauheim (warm, gaseous), Germany.
Droitwich (very strong in salt), England.
Nantwich, England.
Woodhall Spa (also bromo-iodide), England.
Bourbonne les Bains, France.
Châtelguyon (warm, gaseous), France.
Salies de Béarn, France.
Bex, Switzerland.
Wildegg (also bromo-iodide), Switzerland.
Salso Maggiore, Italy.

Among these Weisbaden Kochbrunnen, Selters, Homburg and Kissengen, are obtainable for home use.

BITTER (or aperient) WATERS.

(Containing mostly Epsom salts.)

Cheltenham (chlorides also), England.
Leamington (chlorides also), England.
Brides (chlorides also), France.
Apenta, Budapest.
Hunyadi Janos, Budapest.
Friedrichshall, Germany.
Pullna (chlorides also), Bohemia.
Carabana, Spain.
Rubinat, Spain.
Villacabras, Spain.

Most of these are only used for export, and do not represent drinking spas.

TONIC WATERS.

La Bourboule (arsenical), France.
Mont Dore (arsenical), France.
Bussang (alkaline arsenical), France.
Orezza (ferrugineous), Corsica.
Guberquelle (arsenical, ferrugineous), Bosnia.

Levico Mild and Strong (arsenical, ferrugineous), Austrian Tyrol.
Mitterbad (ferrugineous), Austrian Tyrol.
Pyrmont Steelwater (chlorine, ferrugineous), Germany.
Schwalbacher, Stahlbrunnen (ferrugineous), Germany.

Many of these waters are possible to procure in this country.

Among the American waters that may be used in practice are firstly the imitations of some of the foreign waters that are supplied in syphon and bottle containers by the mineral water concerns. Among those that are readily procurable, and which in my belief when properly made are just as serviceable to use as the more expensive imported waters, are the following:—

Name	Character	Approximate Parts to 100.000 of the Important Salts
Artificial Vichy	Alkaline	Sodium carbonate, 380.1; sodium chloride, 57.8; calcium carbonate, 25; potassium sulphate, 20.5; sodium sulphate, 11.7; magnesium carbonate, 3.5; and total mineral ingredients of 506.338.
Bilin	Less alkaline than Vichy	Sodium carbonate, 300.8; sodium sulphate, 82.6; calcium carbonate, 40.2; sodium chloride, 38.2; magnesium carbonate, 14.2; potassium sulphate, 12.8; silica, 3.1; and total mineral ingredients of 495.598.
Selters	Chlorinated and alkaline	Sodium chloride, 225.1; sodium carbonate, 80.1; magnesium carbonate, 26; calcium carbonate, 24.3; potassium sulphate, 5.1; potassium chloride, 4.6; and total mineral constituents 369.780.
Ems	Alkaline and chlorinated	Sodium carbonate, 140.5; sodium chloride, 97.7; calcium carbonate, 15; magnesium carbonate, 13.5; silica, 4.9; potassium sulphate, 3.6; and total mineral constituents 279.777.
Carlsbad (Sprudel)	Sulphated and alkaline	Sodium sulphate, 240.5; sodium carbonate, 131.5; sodium chloride, 102.2; calcium carbonate, 32.2; potassium sulphate, 18.6; silica, 7.1; lithium chloride, 1.4; and total mineral constituents, 551.6738. This water is also supplied by some firms in double and quadruple strengths.
Marienbad	Sulphated and alkaline	Sodium sulphate, 472.2; sodium chloride, 145.3; sodium carbonate, 114; calcium carbonate, 59.9; magnesium carbonate, 46; silica, 8.8; potassium sulphate, 5.8; ferrous carbonate, 4.5; and total mineral constituents 859.154.

Name	Character	Approximate Parts to 100.000 of the Important Salts
Kissengen (Rakoczy)	Chlorinated	Sodium chloride 582.2; calcium carbonate 106; magnesium sulphate, 58.7; calcium sulphate, 38.9; potassium chloride, 28.6; ferrous carbonate, 3.1; lithium chloride, 2; and total mineral constituents 855.-5908.
Homburg	Chlorinated	Sodium chloride, 986; calcium carbonate. 151.1; magnesium chloride, 72.8; calcium chloride, 68.7; potassium chloride, 34.6; and total mineral constituents 1329.731.
Saratoga Artificial	Chlorinated and alkaline	Sodium chloride, 732.9; calcium carbonate. 144.4; magnesium carbonate, 100.3; sodium carbonate, 30.8; potassium chloride, 21.5; lithium carbonate, 4.7; sodium bromide, 3.3; and total mineral constituents 1047.1746.
Kissengen Bitter Water	Sulphated	Sodium chloride, 795.5; sodium sulphate. 605.4; magnesium sulphate. 514.3; magnesium chloride, 393.3; calcium sulphate. 134.6; magnesium carbonate, 51.9; potassium sulphate, 19.8; magnesium bromide. 11.3; and total mineral constituents 2529.5699.
Pullna	Sulphated	Sodium sulphate, 1611.9; magnesium sulphate, 1212; magnesium chloride, 246.5; magnesium carbonate, 91.8; potassium sulphate, 62.5; calcium sulphate, 33.8; and total mineral constituents 3272.2068.
Schwalbach	Ferrugineous	Calcium carbonate, 15.3; magnesium carbonate, 13.9; ferrous carbonate, 6; manganous carbonate, 1.3; and total mineral constituents 43.1974.
Pyrmont	Ferrugineous and manganous	Sodium chloride, 115.9; calcium carbonate. 100.1; magnesium sulphate, 41; sodium sulphate, 28.9; manganous carbonate, 9.5; ferrous carbonate, 4.3; and total mineral constituents 315.765.
Iron Water (Carl H. Schultz's)	Ferrugineous	Ferrous carbonate, 12.763. Six ounces containing 0.35 grains of ferrous carbonate.
Pyrophosphate of Iron Water (Carl H. Schultz's)	Ferrugineous	Pyrophosphate of iron, 39.0635. six ounces containing 1.07 grains of pyrophosphate of iron.

There are also certain spas and natural domestic waters that may be used for the purpose. The most notable of such are:—

ALKALINE WATERS.

Bear Lithia, Elkton, Va.
Bedford, Bedford, Pa.
Bethesda (calcareous, alkaline), Waukesha, Wis.
Clysmic, Waukesha, Wis.
Londonderry Lithia, New Hampshire.
Saratoga Hathorn (also chlorinated), N. Y.

CHLORINE WATERS.

Deep Rock, N. Y.
Franklin Lithia, N. Y.
Saratoga Congress, Selter, and Kissengen, (the latter slightly laxative), N. Y.

BITTER WATERS.

Mt. Clemens Bitter Water (chlorinated), Michigan.
Pluto (chlorinated and sulphated), French Lick, Ind.
Red Raven, Pa.
Saratoga Kissengen and Lincoln, N. Y.
West Baden (chlorinated and sulphated), French Lick, Ind.
Abilena, Abilene, Kan.

TONIC WATERS.

Abita (ferrugineous), Louisiana.
Rockbridge (ferrugineous), Virginia.
Bedford Alum Spring (ferrugineous), Bedford, Pa.
Church Hill Alum Spring (ferrugineous), Virginia.
Rock Enon Springs (ferrugineous), Virginia.
Vichy Springs (alkaline, ferrugineous), California.
Estill Springs, Kentucky.

Some of the additional practical observations that have come to me in my medical work pertaining to the subject of spas, waters, climates, etc. may be mentioned. The alkaline waters and spas are of the most service in hyperesthetic as well as the hypersthenic conditions of the stomach. They are also of value in the generally neurotic and gouty—to which latter it may be said that the stronger alkaline waters are often not as serviceable as the mild. The presence of a small amount of arsenic in chlorinated waters (Ems) is sometimes of added service in hypochlorhydria. A large class of dyspeptics, who are rendered so by gross feeding and alcohol, those who have congested livers, constipation, lithiasis, gout, or defective elimination with superacidity, do best at the spas or with waters of the alkaline aperient sodium sulphate type. In neurotic and neurasthenic conditions of extreme forms it is best to begin the administration of the water warmed. Carlsbad, Vichy and Neuenahr are the best spas and waters for those with disease of the liver and gall-ducts.

Nauheim, because of the gaseous thermal brine baths, is the preference for cases of cardiac neuroses, valvular and heart muscle disease, and also the high tension arterial conditions, either functional or organic in nature. For neurasthenics it is better to advise going to a spa where the waters are less of a feature of cure than the quiet, good foods and climatic conditions—among these are the less frequented baths, particularly those in the mountains. The three spas most resorted to by diabetics are Carlsbad, Vichy, and Neuenahr in which the warm alkaline waters are obtainable. English-speaking patients who have anemia and chlorosis seem best suited, for social and other reasons, at Schwalbach, Spa, Pyrmont, and St. Moritz; and German patients seem more contented at Schwalbach, Königswart (near Marienbad), Bocklet (near Kissengen), and Driburg in Westphalia.

CHAPTER XV.

Indications for Surgery.

It is one of the pleasant auguries in this field of medicine that modern progress has brought the medical and surgical side of the work so closely together. On the medical side we are arriving at the days of most complete and definite knowledge in the diagnosis and treatment of gastro-enterological conditions. Centered clinical experience assisted by ability in special technique and laboratory procedures are carrying us toward the state of perfection in being able to discern many of the formerly unfathomed conditions which were the parents of the exploratory incision, a rightfully just performance in some of the undiagnosable cases of a grave nature, but a wrong practice if the diagnosis can be reached without resorting to it.

On the other hand, because of the high rates of mortality in surgical procedures of the gastro-enteron, the desirability of practical knowledge of what is wisest to do to obviate or remove the error when the abdomen is opened and the condition is observed, a skilled hand in the way of the various operative procedures pertaining to the surgery of the digestive tract, and the importance of perfect work quickly done, necessitating as it does a good understanding of the anatomy and physiology of the parts, the time has arrived for the existence of special surgeons who have aptitude for this class of work, and whose skill, born of ample experience, is beyond that of the more general surgeon.

I would suggest to help bring this important matter to perfection, that, however the way is reached, satisfactory diagnosis or objects to be desired be first known (if at all possible) by the exhaustion of all clinical means before resorting to surgery. It must nevertheless be remembered by the internist that to be too conservative and drift aimlessly along until conditions have passed beyond the hope of surgical cure before the case is handed over is quite as bad practice as the engaging in hazardous operative exploitation and frenzy without previously knowing just why or estimating the loss and uncertain gain. Each case that is seen is a law quite unto itself, and some cases from their onset, and often afterward, rightfully belong to the medico-surgical class, and not to the medical or surgical side alone. This fact must be observed on both sides, the surgeon often standing

somewhat in the rear until it is apparent that the operative course is wisest to pursue. The knowledge that the surgeon gains by thus waiting and observing is most important to him in the work that may be found for him to do, and thus it would doubtless be that many of the cases that are uselessly operated upon, unwisely or too late for benefit to the patient, would be saved from useless surgical interference, and the surgeon's statistics will perforce be that much benefited.

In the writing of this chapter the author can only be general, giving rules which have served him in the past in the cases he has seen. It is hoped that these as they may present themselves in any case will be helpful to decide when surgical procedure might be resorted to.

MALIGNANT DISEASE.

Cancer is a surgical condition. In its beginning, it is possible of absolute cure when the growth is freely and completely excised. When, however, the growth has gained considerable size and has spread into the stomach walls, the results from removal in the way of recurrence are only poor; while in those cases where the tumor is easily palpable from without, and the mass involves surrounding structures to the stomach with the destruction of the digestive and dynamic functions of the organ the results are generally fatal to the patient and operation should not be performed. Added to these, are those cases of rather slow disease which are not operable in the way of extirpation, but in which a gastro-enterostomy would add comfort and prolong life; and those numerous cases of persistent gastric disorder which are tinctured by the suspicion of the presence of malignant disease in which exploratory incision is a valuable and essential aid to diagnosis.

The first factor in this connection is early diagnosis, and although gastric cancer is a digestive disorder of a primary nature and is frequently encountered diagnosis of the condition in its early stages is not always easy and often is an impossible matter in the medical way. The disease is met with so differently in its course, sometimes rapid, sometimes chronic, and always insidious in its beginning. The cases of very sudden onset are in the minority. Usually it develops at the end of a length of dyspeptic condition in which a history of an early gastric ulcer can often be obtained. There are no definite subjective symptoms characteristic of its pressure in early cases. There may be increasing anorexia, occasional nausea and vomiting, distress after meals, sense of oppression, distaste for meats, and so on, and

igain not one or any other local symptom may be present. Pain, narked vomiting, hemorrhage, dilatation, and tumor are all late local ymptoms. It may be said that the diagnosis of early cancer can ractically never be made by physical diagnostic means alone. Upon what then must we depend? In the order of their importance I would nention them briefly; as, frequent test-meal examinations, general bservation of the patient, daily use of the scales, and only lastly the istory. These in detail are considered in Chapter XXI.

Assuming now that after close attention to a suspicious case the foregoing findings have been obtained, what is the proper course to pursue? Wait until definite symptoms of the disease develop, which are usually those of well-advanced growth? No! An exploratory incision which need not be larger in extent than that through which the stomach can be properly explored by the finger. It must be recalled and always recollected that cancer begins as a small nidus of cells, one too small to give much or any symptom in any way, and that from this beginning it always progressively advances until death unless it had been discovered early enough for its complete removal. That is the course which makes possible ideal surgery in these cases, and by a close medical observance, and then a quick, courageous surgical hand, some of these cases may be saved. The internist must do more than simply determine plain cases for operation, he must also call upon the surgeon for his assistance when the condition is not clear to him and the case is of a suspicious nature. In these modern days of better surgery, as was mentioned before, exploratory incision when properly and carefully done is not attendant with much danger to the patient, and the results possible to accrue from it are often brilliant enough to overshadow the instances in which after its performance it may have proved to be unnecessary. The foregoing remarks also pertain to sarcoma of the stomach.

ULCERS.

Acute ulcers, under ordinary conditions, are medical affections. When they do not heal properly or completely, perforate, bleed too freely, or develop sequelæ, such as marked cicatricial contractions, pyloric stenosis, perigastric adhesions with other organs, or degenerate into carcinoma, they are surgical affections, medical treatment being only palliative in by far the largest number of cases.

There is little question in my mind that a stricter observance to the details of the diagnosis of acute gastric ulcers than to-day is common, a firmer persistency and prolongation of the treatments of rest,

proper dieting, medication, etc., will mean better curative results and fewer cases for ultimate surgery. There are met with, however, several types of cases in which the necessity of surgical procedure comes up for consideration early in the course of acute ulcers.

The first of these, in my experience, is the persistent vomiting of even trivial amounts of carefully selected and prepared foods. In those cases the irritation constantly present in the stomach from the ulcer causes a watery, sometimes sanguineous, discharge which is vomited rather steadily whatever is done in the way of treatment. These cases are seen in the young and middle aged, are usually most acute in their history of onset, and are altogether pitiful. If, after several days or a week of observation, in the face of all treatments, the condition continues in severity, operation is to be considered. The next type is the one in which the intensity of a boring pain in the stomach does not abate with medical treatment (no opiates) after a length of time. Here, the picture is also a sorrowful one. The second week or later of treatment of internal and external measures, rectal feedings to control the epigastric distress, and so on, comes along with the patient in constant agonizing pain, horrified at the sight or even the thought of food, the face intensely anxious and drawn, and the knees raised; operation should be thought of here. Then, again, comes a type of case in which the hemorrhage persists (usually macroscopic) in a constant or intermittent daily flow. Day after day, in spite of all treatments, this continues until the patient is reduced to a state of inanition. Sometimes but little vomiting is present and the feces only present the evidence of bleeding from the stomach (pain even may be little of a feature), but still the loss of strength advances and the better physical picture of the first days in bed fade away in those of extreme devitalization and ante-mortem apathy.

Many of these would be saved, or best relieved, by early surgical intervention, in which it may be said that the rate of mortality is only between 1 and 10 per cent. But how about the cases which usher in with fulminating hemorrhage? Is this bleeding always from a large vessel that can easily be found? No, for in my experience this excessive flow can also come from the most trivial and impossible to find spots or erosions, as well as from ruptured varicose veins in the stomach and open vessels in the ulcer base or sides. In this variety of cases few survive surgical operation, and the rate of mortality from medical treatment is even better than that of surgery. Still such a case may suddenly let up in the bleeding for a while only to flow again as before. Here surgery may be of signal help.

Next comes the case of perforation of the ulcer into the general peritoneal cavity, found in about 1 to 12 of all true ulcer cases that come under observation. When diagnosed they should all be operated upon at once. In these cases the physician shoulders too grave a responsibility in delay. Success of course, hinges upon an early diagnosis, and every hour of indecision and delay lessens the chances for recovery. Perforation is usually characterized by the sudden onset of an intense pain over a strictly localized spot, which on pressure, early in the case, is quite unbearable to the patient. The abdomen becomes rigid, the pulse rapid and small (or maybe as low as 30 to the minute) and the face anxious, angles of the mouth drawn down, and the color ashen. The feet are sometimes found cold, and a cold sweat bathes the body. Here is the ideal case in which the opening is large and free into the peritoneal cavity. Sometimes, however, these general symptoms of shock are absent, and we are not able to diagnose the condition early. Even the local pain may be more or less absent, and we are not on our guard until a more diffuse pain than was present in the case before develops. This means localized peritonitis, and is generally followed (from 1 to 12 hours) by rigidity of the abdomen as a whole. As this rigidity subsides, in its place there occurs a gradual increase in the size of the abdomen, due to paralytic distention of the intestines and the presence of escaping gas in the general peritoneal cavity. When the latter occurs, it balloons up the abdomen quickly, causing an absence or diminution of the liver dullness. The breathing then becomes costal and rapid, because of the upward pressure on the diaphragm.

The patient is restless and generally distressed, and tries to guard against any extra possible movement. The outcome of operation now becomes a grave question, but it nevertheless should be performed, even in the presence of a diffuse peritonitis, for in a few hours more the patient is most liable to be in a moribund condition, and then his last chance of recovery and the moments in which we may have assisted him are gone. Figured in 12-hour intervals after a perforation, the mortality of operations, according to those collected by Boyd, are, in the first 12 hours, 28½ per cent.; in the second 12 hours over 63 per cent; and in the third 12, over 87 per cent. Patients seen after the second day often have localized suppurations, and thus the results are somewhat better.

We are now brought to the consideration of the unhealing ulcer, post-ulcer irritative conditions of the stomach in cases in which an acute ulcer is supposed to have healed, and the truer forms of chronic ulcers.

It must be apparent, not only in connection with the above but also in all of the sequelæ of gastric ulcers, that if more of them were diagnosed and treated properly in the first instance, fewer would be the baneful results from ulcers and fewer the necessities for operation. In an acute ulcer that has made favorable progress during the course of medical treatment one should be guarded in decreeing it as cured until several years have elapsed. How often in our clinical work are seen cases which having a history of ulcer some time back come again under observation with conditions in which the art of medicine can render but little permanent service to the patient. It is my opinion, as well as a practice I would strongly advise, that all of the apparently successfully handled acute ulcer cases be kept under surveillance and carefully examined from time to time so as to observe that conditions really continue as they should.

Clinical ulcer usually means destruction of gastric tissue down to the muscularis, and the tissue, which had died and was digested away, is gone to be replaced by common scar tissue. As compared to the healing of the gastric mucosa from injuries, ulcers of some size heal but slowly and imperfectly at best. The small ones do much better, but how few of these do we see clinically? Many of them do not come under medical inspection, and if so, too often they are not diagnosed and properly treated. Seen at autopsy, healed unknown ulcers in the stomach are not infrequent in my experience.

Ulcers heal by a regenerative proliferation of the connective and glandular tissues that border the ulcer. The cells of the mucosa near the margin of the defect are chiefly concerned in this. All the time while this delicate repair process is slowly taking place, the stomach is secreting more or less hydrochloric acid and enzymes, and acting in the gastric digestion of foods. The truth is, that, even under most favorable conditions, ulcers take weeks to heal, and often there are more than one to go through this process. Now, how simple it is to understand that this same ulcer, acting as it does as an irritant to the stomach, exciting a greater flow of gastric juice and increased motility, is thus unfavorably influenced in its repair process. Added to this is often seen what is common in most continued gastric disorders, an atonic condition of the musculature with the resulting retardation of the food in the stomach, and thus even more prolonged irritation to the ulcer itself. The progress of all acute gastric ulcers are more or less uncertain, both in their duration and prospect of healing. This must not be forgotten or looked lightly upon by the internist. Statistics of medical cures should not be based upon the

condition immediately following treatment. When figuring the absence of sequelæ, it takes three years at least to be sure of this.

After the acute case had been treated a sufficient length of time in bed and under strict observance to diet, constant pain in the stomach coming on immediately after eating and keeping up for weeks, pain which is made worse by the ingestion of coarse foods, such as heavy vegetables, is suspicious of an unhealed ulcer or an irritable scar. Only a feeling of distress after eating might be present in place of pain. While the latter is not sufficient in itself to demand operation, when observed closely over a length of time its relativeness to irritability from food and gastric juice is significant.

A history of more or less steady vomiting is even more important than pain. When pain and distress are also present when the vomiting occurs, and these are at once relieved when the stomach is empty, it is significant of the repair not being in good condition. This vomitus cannot be depended upon to enlighten us in the way of chemical examinations, even when a test-meal had been present in the stomach; but, it is an important matter when blood is constantly present in this vomitus. The latter is not found as a common picture in unhealed ulcers, for many of them remain so and do not bleed at any time. I would advise as a routine in all post-ulcer cases that from time to time the stools be examined for occult blood. The taking of a mild cathartic after 1 or 2 days' fasting from meat, etc., and a test of the feces for blood is not such a difficult matter. Capillary oozing with small amounts of blood passing off from the bowels may continue for months in those cases without our knowledge of it being so unless we look for it. The patients' statements cannot be taken in this, because this blood is usually not recognizable to the eye.

Now come those cases which never seem to get well on any form of stomach treatment or special dieting—"chronic dyspeptics." Their histories are so varied and complex that it is difficult to describe them. Sometimes these persons waste in flesh and strength; then, again, they are found quite well nourished. Their stomachs are always more or less irritable, and when they are fatigued from work they have gastric pain. Some with careful dieting run along and perhaps feel somewhat better, then on the merest dietary indiscretion they renew their vomiting and have return of pains. These persons, characteristically, are always guarding their epigastriums from pressure, the slightest amount of which causes distinct pain. The picture can be almost endlessly enlarged upon, but when after an ulcer a chronic dyspeptic history begins, or that which was present before becomes much worse, and this keeps up continuously, an unhealed ulcer, or an irritable scar

should be thought of, and in both of these conditions the recourse to surgery can give good results. In the majority of cases of this kind, it has been my practice when the conditions seem fair enough to warrant the possibility of its success to recommend first another course of strict ulcer treatment in bed, or a prolonged rest in one of the well ordered sanitariums, or possibly a sojourn at one of the foreign spas, such as Kissengen. These latter measures have brought quite a few of such cases to a satisfactory condition of health and digestion, which no doubt had been accomplished in an indirect way by a better state of local conditions concerning the repair of the stomach ulcer. I am not considering true sensory neurotic conditions in this connection.

The pathology, clinical course, and duration of gastric ulcers differ so markedly in cases that to describe what may be designated as a chronic ulcer becomes almost impossible. Quite naturally, all of the post-acute gastric ulcer conditions, wherein there is a continuation of gastric distress, whether these are directly due to the ulcer being unhealed, or are more on the order of sequelæ following it, are designated as chronic ulcers. But when an ulcer had once filled in with scar tissue, providing this is uniformly intact, it is truly no longer an ulcer in the proper acceptation of the word. What the author designates as chronic ulcers are rather the slower forms of ulcers seen in those past middle life. In the old, whose tissues are not capable of the repair process found in the young, an ulcer is found which has features rather of its own. The ulcer is sometimes of the trestled or shallow running type, most irregular in its shape and often of considerable size. Another form, which is more common, is the one with shaggy looking surface consisting of jagged ends of connective tissue hanging free in the stomach, while below this is a thickening and massing of connective tissue which extends down through the submucosa to the muscular layer. In the first form but little organization of new growth tissue has taken place, and the stomach walls are soft and flat, while in the latter a conglomerate mass under the ulcer may form quite a body in the stomach walls, rendering it stiff at that locality and sometimes for a distance around it.

Clinically, these cases present a chronic form of dyspeptic, in whom most of the classic symptoms of new ulcer or immediate post-ulcer conditions are lacking. Because of prolonged illness, many of these patients become quite cachectic looking and reduce in a slow way to a state of debility.

It must be evident in most of these cases, that little could be expected in the curative way from any form of medical treatments,

although the therapeutic use of the X-rays sometimes offers signal benefit. Because of this, of their morbid nature, the age of the individual in which they are usually found, in which there is an ever present tendency to carcinomatous degeneration, surgical intervention offers the best help for them. I consider the old healed ulcer, in which from contraction of cicatricial fibers and strangulation of the blood-supply and which presents necrotic areas in the scar, as also one of the chronic ulcer types. I might also say in this connection that, excepting in the cancerous form mentioned, that gastro-enterostomy is often curative, but that the excision forms of operations would give the best results in the end in the majority of cases.

It is my belief that in some persons susceptible in that way, even when an ulcer has healed over, and certainly in many of those in whom the chronic form of ulcer exists, a carcinoma may at some time develop. In the healing of the acute gastric ulcers there is frequently found a large number of tubules in the center of the scar. These are usually very irregularly inclosed and are found running in all directions to the free surface. Many of these cavities are cystic in shape and are not lined by the physiological cells found normally in gastric tubules. Instead of these is found a species of cylindrical epithelium which performs no secretory functions, but, as Hauser asserts, are merely adenoid neoplasms. These cells are inclosed in connective tissue which at the best, as time goes on, is but poorly nourished, and this, subjected as it is to the constant mechanical irritation of foods and gastric motility, together with the chemical irritation of HCl acid juice, may proliferate into the formation of malignant disease. The first thought in these cases of chronic ulcer should be operation, which in form as the wisest course to pursue depends much upon the history of the case itself, on the condition locally and generally, and again according to when the condition is first seen or diagnosed. It would here be well to remember that many of the carcinomatous ulcers are impossible to diagnose in their beginnings, and sometimes even late in their course when they are incapsulated in structure and formed, because they often are outside of the free surface of the stomach; thus it is, that a rather liberal leaning to the surgeon is generally necessary to assist in making an early diagnosis for us.

Another word may be said regarding the desirable form of operation for chronic ulcers, and the subject of diagnosis between cancer and benign ulcer at operation. It must be remembered that whatever the appearance or feel of this ulcer may be, whether saddle-shaped or otherwise, soft or densely thickened with induration, or wherever it may be situated, in the pyloric region or in the lesser curvature, the

best forms of operations are those in which the entire disease tissue could be removed (excision, pylorectomy or partial gastrectomy). Of course, where extensive adhesions with surrounding organs are found, such operation may not be possible, but it must be understood that gastro-enterostomies are operations merely for better drainage and have only to do with improving the dynamic and chemical status of the stomach for the ulcer's healing, and not with the complete cure of the actual condition. A number of the patients of the cancer age who have had benign ulcers at the time of gastro-enterostomy, subsequently improve, only in the course of time to develop malignant disease. And it may further be said that gastro-enterostomies, even when the results from them in the purpose for which they are performed were successful, are sometimes a failure in the benign ulcers when these have been of long standing and are organized with new tissue.

An indurated gastric ulcer may be in the early stages of carcinoma development and when seen and examined be impossible of naked eye diagnosis. The carcinoma cells may be discreetly scattered in the ulcer base or edge, and be very few in number. I have seen a case of perfectly soft ulcer of small size in the lesser curvature, which looked entirely innocent from a malignant standpoint on the mucosa side, but which presented a wart-sized, carcinoma nodule on the peritoneal surface of the stomach some distance from it. Finney reported 2 cases in which at operation with the abdomen open he was unable to decide whether he was dealing with a carcinoma or an ulcer at the pylorus. Examination of frozen sections for diagnosis in the operating room means the dangerous cutting into tissue that may be malignant and the spreading of the carcinoma cells. Then again, if the report be benign, the results of these quick examinations are not to be depended upon. At the expense of repetition, chronic ulcers and those which are not properly healed, however innocent looking they may be, should be removed if at all possible; gastro-enterostomy being only the second choice.

Pyloric stenosis following ulcer may come about in one of four ways—cicatricial contraction, malformation resulting from a rather general thickening of the connective tissue in the stomach walls, the drawing away or binding down of perigastric adhesions, and malignant disease. To these may be added the kinking of the first portion of the duodenum due to downward pulling of a heavy, dilated stomach.

The most difficult point medically in the treatment of gastrectasia following gastric ulcer is the matter of just what the dilatation is due to—whether it is a plain atony or one secondary to obstruction to the easy flow of chyme through the pylorus. It is important to keep

in mind that about 10 per cent. of pyloric stenoses follow gastric ulcer, and that when this occurs medical treatment can offer little in the way of a permanent cure. When, however, this stenosis is benign in nature and slight in extent, much in the medical way can be done in the manner of satisfactory relief; when it is moderate, by the strictest care, these cases can be kept comfortable; but when there is distinct stagnation and fermentation of foods, the case is decidedly surgical. One must not be led astray in too hastily decreeing stenosis in the cases of acute ulcer which presents much relaxation of the stomach during their course, or the simple atonies that may follow.

Cicatricial contraction of an ulcer situated at the lesser curvature or some distance from the pylorus if it is of considerable extent is liable to cause marked constriction. These constrictions are also found nearer to the pylorus and in the duodenum itself, and but very rarely near the cardia. The typical hour-glass stomach of even proportions is rare and easy to diagnose, but the irregular forms, where the constriction is near, at, or beyond the pylorus, require more detail, time, and patience in their clinical discernment. Those ulcers which are followed by much annular thickening in the stomach walls and the pyloric stenosis of late hypertrophic gastritis are distinct surgical conditions.

In the observance of the scarred states, and the selection of cases for surgery, as well as those of perigastric bands, the X-ray pictures with bismuth in the stomach are most helpful. The seven or more hour extraction of the Leube test-meal are not so helpful. The washing out of the morning stomach after a heavy mixed meal the evening before, and the finding of food remnants are of course very valuable to these ends, but results in this are observed only in very marked cases of stenosis. Likewise, also valuable, are the outside observances of the cramp-like peristaltic waves forcing food through the obstructed pylorus. Those cases with distinct collective vomiting, intense thirst, diminution of urine, tetany, and marked fermentation, are all of more or less complete stenosis, and for which the excisions, pyloric plastic operations for adhesions, or gastro-enterostomies may be resorted to.

The last class of cases in which operations are indicated, are those with the presence of benign growths, such as large-sized obstructing polyps or papillomata. The congenital stenoses (of which I have seen 3 cases go on to adult life) are also included, as well as those of foreign substances in the stomach, as hair balls, or the swallowing of improper articles as may be observed in those of vicious habits, such as in the hysterics or the insane.

The internist must be fair to his patient, and deliver to the sur-

geon many of the cases of generally termed "chronic dyspeptics" when these do not improve or become worse under his care, and in which surgery offers possibilities of a better therapy than would be at his command. All cases in which this is advised should first be carefully examined and, if possible, diagnosed in advance, and reports given to the surgeon as to what his findings may be as well as any suggestions that may be logical. When a severe case continues to present a mystery, a kindly disposed and understanding surgeon, cognizant and discreet, can, by the performance of an exploratory incision, be of inestimable help. Neither side can be firm of stand, for gastric surgery before five years ago has no more to its credit than had the internist in logical diagnosis and treatment. To-day, mistakes on both sides are gradually disappearing; and knowledge and understanding are growing toward perfection in this field of medicine.

CHAPTER XVI.

Gastric and Esophageal Surgery.

GENERAL CONSIDERATIONS.

SINCE the memorable advent in medicine of antiseptic and then aseptic surgery, operations upon the organs in the abdominal cavity, as well as those in the thoracic and cranial cavities, have been largely robbed of their terrors. To-day, generally throughout the world, surgeons are awake to the therapeutic possibilities existing in surgery of the gastro-enteron and the accessory organs in the abdomen concerned in digestion (gall-bladder and ducts, liver, and pancreas), and this field of work is not only receiving an intense degree of interest, but in many substantial ways has passed the experimental stage and developed into one of inestimable service away beyond the possibility of results from the employment of what may be termed medical measures alone.

The foregoing chapter pertains more particularly to those cases in which diagnoses are possible of being made or strongly suggested. But in clinical work many if not the majority of cases seen come to us for the first time with a length of masked history or a complex multiplicity of symptoms and upon examination no definite clinical suggestions sanctioning early surgery may be noted. For these reasons the author feels that it would not be amiss to consider this subject from the opposite standpoint, namely, that in which the indications of surgery develop from certain symptomatic findings rather than from definite diagnoses.

The intimate anatomic and functional relationship of the organs in the upper abdomen, the stomach, duodenum, pancreas and biliary apparatus, often makes definite diagnosis difficult because of the similarity of the symptoms occurring in different diseases of these structures. In distinguishing these from one another, close attention to details in the history are most helpful. In gall-stone diseases, although the majority of the cases have no definite symptoms such as recurring jaundice, biliary colic, passage of stones in the stools, etc., the long history of digestive distress independent of the taking of food and the comfort on an empty stomach are suspicious. With these a

sense of constriction in the epigastric region may be described and a soreness and localized tenderness under the liver, these attacks being accompanied with a sensation of chilliness or cold or nausea.

In subacute and chronic gastric and duodenal ulcers a long history of digestive distress may be present in which there is more or less pain in the stomach not relieved by eating or in fact not influenced in any way. No vomiting may be present and only an indefinite nausea, although a more or less degree of anemia or inanition usually exists. In duodenal ulcer the characteristic one- or two-hour pain after eating may not exist, and the form Mayo Robson described as "hunger pain" be present; in this the patient feels best when food is in the stomach and more or less constant taking of foods is required to limit or obviate the sensation. Unlike in gall-stones or pericholecystic adhesions, however, these patients are liable to have some degree of real anorexia, vomiting is more common, and the pain is described as nearer to the median line.

It must also be mentioned that appendix disease may give but few local manifestations, most of the symptoms being referred to the upper abdomen and due to a pylorospasm reflexly brought about. Also of much interest in this connection are the diagnoses of acute and chronic pancreatitis. In the sclerosing form a long history of digestive disturbance alternating with health, inability to digest certain kinds of food, and alternating diarrhea and constipation may be described. The acute form may be mistaken for perforative peritonitis or intestinal obstruction.

Regarding the side of the physical examination a portion of a recent article of mine on the subject may be offered (Long Island Medical Journal, May, 1910):

"A patient who gives a suggested or definite past history of ulcer, who, after the acute symptoms have subsided, has a continuation of digestive distress should be most carefully and exhaustively examined and if nothing definite is found should again be placed on the rest and food treatment, and if after this the patient is not substantially improved the case is operative. With cases giving such a history of ulcer, the more or less constant presence of blood in the test-meals and feces, a stomach continuously intolerant to foods, evidence of delayed exit of foods from the stomach, or a stomach noted by X-ray to be globular (dilated) or showing irregularity in its contour is operative from the beginning, it making no difference whether gastric hyperacidity, hypersecretion, subacidity or anacidity be found. Also, a patient in the empty stomach of whom are found small blood-clots, many leucocytes, a high bacterial content, and shreds of connective

tissue, and the test-meal therefrom shows a high acidity and from which, when the free HCl had been neutralized, more than a 2-per-cent. gas result on standing twenty-four hours in an incubator is seen, means a greater bacterial content than a normal stomach should have, and high bacterial content fermenting the saccharides in the face of abundant stomach secretions in the organ most probably means latent ulceration and therefore is operative. We have no means of recognizing the early stages of a carcinomatous degeneration of an ulcer, and the fact that benign pyloric stenosis as well as simple chronic ulcer is often subject to cure by surgical procedure, when a pyloric stenosis exists operation is a perfectly justifiable procedure in every case that gives an early history of ulcer. But it is in those cases in which no ulcer history is obtained or suspected and those in which the differential diagnosis lies between anacidity, gastric neurosis and carcinoma that great care must be taken. In these, in my belief, we should hold off advising operation when no pyloric stenosis exists, and when it does or comes on, advise it in every instance.

"Whatever the diagnosis, or if none definite can be made, and providing it is not splanchnoptosis, a patient that does not improve on the most logical medical treatments for the condition, and particularly if the patient displays rapidly progressive loss of weight, strength, and asthenic blood change, that case is operative. If the diagnosis of hyperacidity or hypersecretion or atony had been made and the case does not improve in a reasonable length of time on proper medical treatment it probably is operative. In a general way, it should be remembered that the longer the history of digestive distress, the greater is the proportion of operative cases.

"If a mass is palpable in the upper abdomen, and it is not a loose kidney or liver, it is operative, but in a typical stagnant stomach giving an achylic return with lactic acid and many Boas-Oppler bacilli, the combination must be clinically looked upon as a questionable operative case of carcinoma of the stomach. In such an instance, the blood condition, rather than the general condition of the patient, should guide us. If the blood reduction in hemoglobin and erythrocytes be great, operation is liable to be fatal, and it is fairer to allow that patient to die in the few days that are left to him rather than add mutilation to his raised hopes from operation even if a gastro-enterostomy be successfully performed.

"A case of gastric distress, whatever the stomach diagnosis, which constantly has present a point of tenderness located definitely in the biliary triangle (which runs from the top of the ninth left costal cartilage to the umbilicus) or appendix region is medical for a month, and

operative after that if substantial improvement had not been made. Likewise, if a gall-stone case had recurrent attacks of biliary colic with jaundice, or if an acute attack of appendicitis with fever had been present the cases are operative at once.

"If the gastric distress comes on with or shortly following a deterioration in the general health the case is medical, and operative at once should a perforated gastric or duodenal ulcer be diagnosed or strongly suggested. Many surgeons recommend that in all cases that are suggestive of cancer of the stomach in which a diagnosis cannot be absolutely made the patient should be subjected to operation. With Kuttner, I am opposed to such a general rule. I recognize that there exist certain cases in which operation is advisable, but always about us are seen cases of gastritis anacida, gastric atrophy and certain neuroses in which no HCl is present, and certain of these and others have retardation of food from primary atony, and again, many that have secondary gastric conditions from functional and diseased conditions in other organs. In every one of those operation would be criminal. Only the other day a case I had seen of late atrophic gastritis with nephritis was operated upon by one of our best surgeons in the largest city hospital we have for a suspected gastric carcinoma, with the result that nothing was found and after which the patient died—was this right when the true diagnosis was so easy to be made?

"A nephroptosis with a freely movable kidney and in which Dietl's crises exist is operative if the attacks do not cease after a month of treatment with support and constructive medical measures. When even under apparently successful medical conditions, the seizures are followed with blood in the urine it is an operative case.

"A case in whom the bowels have always been regular and in whom constipation is rapidly becoming pronounced and leading to obstipation and the general body is failing, and there are not to be found definite medical reasons for this progressive constipation, is operative.

"A blow on the stomach or a fall from a height shortly followed by the vomiting or the passing of blood per rectum and any abdominal wound that penetrates or perforates the abdominal wall are operative cases at the earliest moment.

"A case which presents a fixed mass anywhere in the abdomen is operative providing large doses of iodide of potassium do not cause its disappearance. Operation is indicated in post-operative abdominal conditions in which the vomiting or stomach contents obtained by tube display [illegible] the constant presence of bile, pancreatic secretions and fecal substance; and in these cases do not wait until the symptoms of collapse come on.

"An X-ray plate that shows a stricture of the colon, or when the feces constantly display the presence of blood and pus, and particularly if on digital and proctoscopic examination of the rectum nothing is noted to account for it the case is operative. If a growth is noted in the rectum it is operative, but if rectal discharges are from a tubercular or syphilitic ulceration of the colon it is not.

"I wish to make a plea to general practitioners to seek the diagnostic help of the skilled internist earlier and in more of the patients that do not improve under treatment in his hands, and also to many of the internists to seek the help of the surgeon oftener than is now customary. The average surgeon is most respectful and does not look lightly upon diagnostic medical work that is well done, but most of that which comes to the surgeon is not thoroughly enough analyzed or deeply enough considered from the medical standpoint. More cases should go before the surgeon for exploratory incision to see why certain conditions are so, rather than for him to explore to see if something can possibly be found. Of course, there will always be some cases of the latter group, but if we all do better medical work, and work together more conjunctively than we now do, these will not be as numerous as they are to-day. A most unfortunate fact lies in that enough cases are not exhaustively analyzed from the medical side, and in that many of the fine points of clinical procedure, readily at hand, are not utilized in the examinations. My experience and observations with the majority of surgeons I have come in contact with have been that, in a general way, surgeons have not the time, inclination, technical skill, deductive clinical ability, or temperament to diagnose those affections in the ways given to internists. The solution of this difficult subject will always remain where it should be—in the diagnostician's hands, and in my opinion, to minimize the dangers of mistakes, matters of surgical diagnosis should follow and not precede him."

In the work of such masters of the surgical art as Moynihan, W. J. Mayo, Finney, Mayo Robson, Hochenegg, Czerny, Helferich, Crile, Demoulin, von Eiselsberg, Hartmann, Kocher, Mikulicz, and the many others whose names for the moment I do not recall, the civilized and intelligent world owes an everlasting debt of gratitude. These men in the development of abdominal surgery have enlarged the therapeutic side of gastro-enterology to such an extent that many instances of permanent conditions and even malignant disease are rendered possible of palliation and cure by the hand of man. From a medical standpoint they deserve more credit than only appears on the results they have gained, for in the course of the evolution of their labors they have not been without enemies from the internists' side, some of whom,

I am sorry to say, still hold too fast to fruitless or temporizing medical measures.

On the other hand, based upon the many glittering results that have been obtained by surgical procedures a to some extent just as deplorable condition of affairs exists in part of the surgical ranks. Born in the enthusiasm of the subject many surgeons look lightly upon the scope of the internist's ability to clinically diagnose conditions, or have insufficient time, practice, or ability to do this themselves, and thus reach too quickly for the scalpel for diagnostic purposes. In the clock of progress on the subject, the pendulum which a few years ago was an ultramedical consideration and in which surgical intervention was rarely more than an emergency or an extremis measure, the pendulum is now swinging ultrasurgically and some of the glittering results thus obtained are clouded with improprieties and unnecessary operations. I personally feel that it must swing back to a more proper equation between these two extremes. Excepting in such emergency conditions as penetrating and perforating gunshot or stab wounds of the abdomen, perforating ulcer, quick peritonitis, fulminating septic, perforating and gangrenous appendicitis, etc., a case should always be exhausted medically before it rightfully becomes surgical in nature—either because of the existence of a distinct surgical condition, or because the diagnosis is impossible to be made in the medical way. Continued great results in surgery are only possible in this medico-surgical combination, and, to my belief, it is partly because the clinical diagnosis methods are well recognized and exhaustively employed by the most prominent surgeons that these men have reached the eminent standing that the results of their work justly deserves.

In this volume the author will merely give a short résumé of some of the well recognized types of operations employed, including the results from them that have come to others and himself. The preparation of patients, operative technique and the full consideration of the subject from a surgical standpoint can be found in works on that department of the subject. Not being a surgeon myself, I feel that I am not qualified to write upon it, particularly when I consider that, as often happens when the abdomen is opened and the pathological condition in each case is observed, so many modifications of set operations or new ones for that particular case are indicated that to give a description of the set operations would not serve to much benefit.

EXPLORATORY INCISIONS.

Parts of this subject were treated in the foregoing chapter and also in that of gastric carcinoma (Chapter XXI, page 612). Suffice it here to say that when properly performed the rate of mortality is so low that it may be disregarded in the light of the great benefit possible from directly feeling and viewing the internal structures. A word may here be entered that in each instance a complete or at least an adequate examination of all the parts concerned be made, because small cicatricial areas in the stomach may be overlooked, an hour-glass stomach may escape recognition by the dilated pyloric pouch being mistaken for the entire stomach, one stricture of the stomach or intestine may be operated upon when multiple strictures are present (and so also with ulcers), a gall-bladder may be emptied of stones leaving one in the common duct, an appendix may be removed leaving a much worse pathological condition in the intestines, pelvis, or elsewhere in the abdomen, and so on. A few extra moments spent in painstaking examination of all the parts affected, or likely to be, is often well paid in the results. Every laparotomy carried on for a definite purpose is at the start exploratory in nature.

To enter into a delineation as to which of the not surgically plain cases the internist should recommend an operation would call for an endless narration. As no two individuals in the world are absolutely alike in looks, form, or shape, so no two cases are clinically identical in nature. Because of the chronicity of many digestive disorders that are met with in which surgery can offer nothing to a patient beyond the moral effect of operation (which is a matter both the internist and surgeon should never take into consideration in any case), one should not be too hasty in endeavoring to clear up the situation. Much depends upon the history of the case, the character and complexity of symptoms, the running state of the general condition of the patient; the last, in my opinion, is the most valuable guide to go by, unless such symptoms as exist make possible definite diagnosis of a serious condition for which surgery can do nothing. A close clinical study of each individual case will generally sooner or later direct one as to the proper course to pursue, and when in doubt and in the presence of a continually severe or progressive condition particularly when abdominal pain is constantly present, a surgeon is often a most beneficial helpmate.

Adhesions are frequently encountered in abdominal operations. They are the result of inflammations, and, when they are attached to a movable organ like the stomach, they often are the cause of

great distress and should be treated by separation and surgical attention. The results in the great majority of cases of perigastric adhesions I have had operated upon have been good, particularly in those attached to the liver and diaphragm, where, after separation, the omentum could be folded over the roughened area.

The term gastrotomy is given to operations in which the stomach cavity is entered by incision, either for the purpose of exploration, as a preliminary to dilation of strictured states of the cardia, esophagus, or pylorus, to control hemorrhage within the stomach, for the removal of foreign bodies, polypi and pedunculated tumors, or to bring the posterior wall into the field of surgery.

THE RESECTION AND PLASTIC FORMS OF OPERATION.

According to Deaver and Ashhurst[1] these operations are described as follows: "The terminology employed by writers with regard to excision of portions of the stomach is not always uniform, and unless the terms used are clearly defined confusion is liable to arise. We employ the following terms to designate the operations. Sphincterectomy: By this we understand the removal merely of the pyloric sphincter, with end-to-end reunion of the duodenum and the stomach. It is an operation which in a few rare instances has been employed for benign fibrous stenosis of the pylorus, in which the prepyloric portion of the stomach was healthy.

"Pyloroplasty, we think, would be a less dangerous and quite as satisfactory an operation. By pylorectomy we mean removal of the pylorus; it is a more extended resection than sphincterectomy, but less so than partial gastrectomy, in which latter operation the entire lesser curvature of the stomach is removed. It is not always possible during an operation to determine the precise limits of the pyloric antrum; but, in general, we mean by partial gastrectomy an operation which removes, besides the pylorus, also the neighboring part of the stomach as far as the Hartmann or Mikulicz line, always including the whole of the lesser curvature. If the gastric area removed extends still further toward the fundus along the greater curvature, we speak of the operation as sub-total gastrectomy; while the term total gastrectomy is reserved for operations which leave behind no portion of the stomach, the upper section passing through the lower level of the esophagus, while the lower section of course divides the duodenum. Circular or cylindrical gastrectomy designates an operation by which the central portion of the stomach is removed, neither the pylorus nor the fundus being included in the section, although the lines of division

extend from one curvature to the other and involve the entire circumference of the stomach. By gastric resection we understand removal of a portion of the stomach not including the entire lumen of the organ; the term plastic resection we think therefore properly describes the operation called gastroplasty by Jedlicka; since in this operation, after resection of a portion of the anterior wall of the stomach, he reconstructs the organ by a plastic operation. Excision in connection with gastric operations we would limit to the removal of more or less circumscribed lesions or pedunculated tumors attached to or springing from the stomach." To the plastic operations may be added the invaginating operation employed for the closure of perforations, which, although not strictly plastic in form, are nevertheless plastic in nature.

The pyloroplasty operations now universally accepted as capable of the best results are the Finney modification of the old fashioned pyloroplasty, the Y operation of Durante, and the Kocher method of lateral gastroduodenostomy. All three are valuable operations in suitable benign cases, and possess the advantage of relieving the stenosis by the giving of an outlet in a more natural location than the gastro-enterostomies. The terms gastroplasty, gastrogastrostomy and gastro-anastomosis have been given to the various types of operation performed for hour-glass stomachs; their choice depends upon the anatomical condition of contraction noted in each case. The term gastroplication is given to a tucking operation employed to decrease the size of large (atonied) stomachs, and gastroplexy to an operation designed to fix a prolapsed stomach to a higher plane in the abdomen; both of these operations do not give the therapeutic results for these conditions that the medical can, and, in my opinion, are unwarrantable surgical procedures.

OPERATIONS FOR DRAINAGE OF THE STOMACH. GASTRO-ENTEROSTOMIES, AND STATISTICS OF OPERATIONS.

The pyloroplastic and gastroplastic operations for this purpose having been considered, there remains practically the two forms of gastro-enterostomy that are universally adapted. In these, because of the close anatomical proximity of its upper part to the lower regions of the stomach, the jejunum is employed to form the drainage canal from the stomach. With their modifications, there are two main types of this operation, the anterior gastrojejunostomy and the posterior gastrojejunostomy, the first being the joining of the jeju-

num with the anterior stomach wall, and the second with the posterior. To these may be added the gastroduodenostomy operations wherein the stomach is joined with the duodenum—leaving the pylorus intact—either by joining elliptical slits in both organs, or by cutting the duodenum transversely and joining its entire lumen to the stomach, and lastly, the latter operation in which a pylorectomy is also done and the duodenum joined to the lower edge of the sutured stomach wound.

The various forms of gastro-enterostomy are short-circuiting operations and, like all such procedures, act best when a gross mechanical obstruction exists in the normal path of the stomach and intestinal contents. Experiments have shown that when the pylorus is normal, and there is no impediment to food within it, the opening made in the operation of gastro-enterostomy does not allow of the escape of any of the gastric contents into the intestine. For this reason these operations should only be employed when stenosis exists in the prepyloric or pyloric regions of the stomach or in the duodenum, and not to establish better drainage to encourage healing of a gastric ulcer, unless in its repair or excision a surgical stenosis is formed, or, as was suggested before, a demonstrable organic stenotic lesion exists. An exception to the performing of a gastro-enterostomy in ulcer without stenosis exists in the long-standing, markedly organized ulcers with much formation of connective tissue and adhesions with enlarged and engorged vessels in which excision or partial gastrectomy would be impossible or too dangerous. Because of the most troublesome surgical complication of regurgitant vomiting after gastro-enterostomies (due to the presence of a loop in the jejunum, or to a twist in the intestine around its longitudinal axis at the time of its application to the stomach), the posterior no-loop operation with the vertical application of the bowel to the stomach is the best procedure.

The results from these operations are often particularly brilliant. When performed on suitable cases patients gain in weight and strength, lose their epigastric distress, and often forget the previous constant indigestion. In their more comfortable existence, better metabolism and freedom from digestive disorder, the objections of many internists that the functions of the stomach are seriously interfered with by the operation are obstructive and senseless. The motor condition of the organ is most strikingly improved, and if bile, pancreatic juice, and the intestinal secretions are regurgitated into the stomach, it is comparatively a small matter when you consider that by the proper medical means these conditions can be successfully coped with. I do not believe that they should ever be performed in

any case of excessive secretion even of the most persistent and troublesome type, since proper medical measures long persisted in usually control the case in the end; nor in chronic ulcer should they be given the preference over the resection operations (simply on the good and valid reason that these ulcers may at the time or subsequently become malignant in nature). Quite logically in ulcer—the most common surgical condition of the stomach—the internal treatments should first be given a fairly long trial before operation is advised.

On the other hand, the clinical results from gastro-enterostomy are not always good even when performed for benign obstruction. In the latter is the immediate mortality which, in a general way, is about 10 per cent., about 30 per cent. eventually die or are not improved, about 2 per cent. develop cancer at some time after, and secondary operations are required in about 3 per cent. of all instances. In so far as gastro-enterostomy itself for these cases is concerned it may be stated that about 60 per cent. are either rendered well or much improved by it. In gastro-enterostomy performed for cancer the immediate mortality is high, usually about 35 per cent., while that done for ulcer is the lowest, around 3 per cent. It must be evident that the operation performed in cancer can only offer a short length of benefit in the local subjective symptoms and the moral way. Recently I have advised its performance in a few cases of late cancer in which the mass was comparatively small and very hard, the history of its development rather long, and the general condition of the patient good enough to warrant its performance. But when the mass is large, the history of illness short, and the general condition and blood content in hemoglobin and red cells low, no operation should be performed. In ulcer when possible of performance the excision forms of operation should always have precedence over gastro-enterostomy.

In presenting the statistics of the best known abdominal surgeons on the various surgical conditions and the different forms of operations for them, the author has adapted an average deduction of all of the statistics on hand. This occurs to me as a more generally practical presentation than to detail the results of the different operators. The published reports of the various surgeons often show a great difference, and no one or a few surgeons could operate on all of the cases that exist. Gastric carcinoma is a disease that is rather commonly encountered by most general practitioners of medicine, and ulcer perforation happens so quickly, the time for the operation is so short, and the danger of removal so great, that the majority of the cases must be cared for by the local surgeons in each neighborhood. For these

reasons, the author asks pardon for not including in the statistics many of the well-known names of abdominal surgeons, and hopes that the general statistics included (which contain the most recent figures) may serve for better general guidance.

Operations for Benign Diseases of the Stomach.

(14 Surgeons)

Number of Operations	Deaths	Mortality per cent.
1650	95	16.3

End Results of Operations for Benign Diseases of the Stomach.

(8 Surgeons)

Cases Traced	Cured	
897	758	84.5 per cent.

Results of Operations for Gastric Perforation.

(18 Surgeons including Hospital Records)

Cases	Recovered	Died	Mortality per cent.
215	115	91	42.3

Results of Operation in Time After Perforation.

Duration of Perforation	Mortality per cent. Gross and Gross	Brunner
Less than 12 hours	25.00	25.00
Less than 24 hours	52.72	46.00
Less than 48 hours	56.06	58.00
More than 48 hours	73.91	80.00

Results of Operation Within the First Few Hours after Perforation.

(Gross and Gross)

Within the first five hours	31.03	per cent. died
Within the second five hours	16.25	" " "
Within the third five hours	42.85	" " "
Within the fourth five hours	54.00	" " "
Within the fifth five hours	57.14	" " "

In statistics covering more cases it will probably be found that the difference in figures between the second five hours as compared to the first five hours no doubt represents to a degree operations performed during shock. While in occasional favorable instances it may be advisable to wait until the symptoms of shock have subsided, because of the great uncertainty as to whether in any severe case the shock may be continued until too late for the possibilities of a favorable outcome from operation, and also because of the danger in waiting (irremediable peritonitis) it is best to have all cases operated upon at the earliest moment after the diagnosis of perforation is made. Most perforations are nearer to the lesser curvature than the greater and in the pyloric region and duodenum. A word may here be included as to the advisability of doing a gastro-enterostomy that commonly arises when a perforation in the stomach near the pylorus has been repaired

(often the pylorus seemed to be so narrowed by the stitches that doubt exists as to whether it would not be wise to cause better drainage of the organ in this way). My observation has been that even a thus much narrowed pylorus often answers for the complete recovery without a gastro-enterostomy being done, and because of this when local conditions are at all favorable I usually favor the doubt, wait for recovery, and advise doing a gastro-enterostomy later if required. When there is evidence that more than one ulcer exists, even if the others have not perforated, and particularly when these are also observed in the duodenum, it is best to do a gastro-enterostomy after the repair (this, of course, assumes that the patient's general condition will stand it).

Operations for Duodenal Perforation.
(Robson's Compilation)

Time	Cases	Recovered	Died	Mortality per cent.
Under 24 hours	61	38	23	37.7
Over 24 hours	63	11	52	82.5
Not stated	31	3	28	90.3
	155	52	103	66.66

Operations for Hour-Glass Stomach.
(After Schomerus)

Cases	Recovered	Died	Mortality per cent.
138	121	17	12.3

Partial Gastrectomy for Carcinoma.
(25 Surgeons)

Cases	Deaths	Mortality per cent.
1009	237	23.4

Of these about 25 were well three years after operation, and about 10 or 15 per cent. were permanently cured without liability of recurrence. (The value of an early diagnosis either by medical or surgical means or both together is apparent.)

Gastrojejunostomy for Carcinoma.
(9 Surgeons)

Cases	Deaths	Mortality per cent.
645	184	28.5

Because of the lateness in the course of malignant disease at which the great majority of gastric cancers have been diagnosed the above is often the only operation that can be performed. In the instances of these cases that have been operated upon which I observed I have my doubts that the relief of symptoms and the prolongation of life from gastrojejunostomy has justified the performing of it. In the first place the rate of mortality, because of the unfavor-

able local conditions in the stomach for the operation and reduced general state of the patients to withstand it is much higher than is that of gastrojejunostomy done for non-malignant conditions. Up to the date of writing I have records of 127 such instances with an operation mortality of 37 per cent., and I have not observed that even in the hands of most abdominal surgeons who are well abreast with the advance that gastric surgery has made in recent years this rate is being precipitately lowered. The effects of the operation on the relief of the subjective symptoms of distress and the improvement in the general condition were marked in only a few instances. The malignant growth being left in the patient, the pains are not lessened to a practical degree, and by the extension of the growth the little benefit that comes from better stomach drainage is soon lost by the advance of the malignant disease in its constitutional effects upon the body. The ideal care of these cases is to diagnose early enough for complete removal of the growth, an operation that should always be done if at all possible even if the danger of a fatal outcome from the operation is materially increased; if this is not possible and the malignant involvement is not too extensive, an anastomosing operation may be done as a poor second choice; and lastly, if the malignant growth is quite diffuse in the stomach walls, or considerable involvement with the surrounding organs and tissues is observed, or more or less of a metastatic condition noted in the liver and peritoneum, it is best to close the abdomen without further surgery.

Operations for Gastric Sarcoma.
(Lecéne and Petit)

Cases	Recovered	Died
30	17	13

OPERATIONS FOR ESOPHAGEAL DISEASE.

The operation of gastrostomy is performed in cases of impermeable stricture of the esophagus or malignant disease of the cardiac orifice of the stomach for the purpose of introducing food into the interior of the organ. There are a number of different methods for the purpose, but those of Senn and Witzel seem the most satisfactory by both answering for the purpose and not requiring much cutting of tissue to accomplish them. A suitable time is desirable for the performing of this operation, which should not be too soon or too late. These are judged by the factors present in each case, namely, whether the stricture can be kept patent enough by dilatation that the individual can deliver enough food into the stomach to maintain his nutrition; and if not, by performing the operation

before the reduction in vital strength and weight is too great to permit of surgical procedure. In the latter instance, a few patients can be improved in general condition and helped so that they can withstand the operation by passing a small silk catheter through the stricture (usually a very difficult matter), and by keeping the catheter constantly in place, and feeding the patient at intervals through it; a tube like this may be kept *in situ* for several weeks. The operation can occasionally be done under cocaine anesthesia in these commonly thin-walled subjects, although, of course, general anesthesia is preferable. The operation has been performed in cases of diffuse peritonitis and phlegmonous gastritis, but usually without benefit.

An operation for impermeable esophageal strictures has been devised by Abbe called the "string-cutting method." In this the esophagus is entered through an incision in the stomach by means of a filiform, a string is then drawn upward through the esophagus and mouth, and by dilatation with a Billroth bougie, or cutting the stricture by string sawing, the narrowing is enlarged in caliber. A gastric fistula is left so as to insure that feeding can be kept up, and the stricture is regularly dilated from above until swallowing is possible, after which the gastric fistula is closed. According to Abbe,[2] very tight or impermeable strictures can always be safely, quickly, and permanently cured by gastrostomy followed by the string cutting. This operation should not be employed for esophageal strictures resulting from causes like presence of mediastinal tumors, aortic aneurism, and in malignant stenosis; in these the permanent gastric fistula free from leakage is indicated.

Recently a marked advance in thoracic surgery has been made possible by the use of one of the various cabinets in which positive or negative pressures can be kept up during operation. Sauerbruch, a pupil of Mikulicz, constructed the first negative air-pressure cabinet making possible for the first time opening of the thoracic cavity without a resulting pneumothorax and collapse of the lung when the pleural cavity was opened. Since then numerous cabinets have been devised, and lately Meltzer discovered what appears to be the true physiological principle underlying respiration with the pleural cavity open. He suggested for these operations the use of a tube half the diameter of the trachea, the tip of which is placed near the bifurcation of the trachea and through which a continuous stream of air is run with a pressure of about 20 millimeters of mercury crudely obtainable with an ordinary foot-bellows. If a bottle of ether is placed in circuit with the air-tube, narcosis proceeds so nearly automatically that it requires but little attention. By the use of this simple apparatus, even

quent to the performing of an appendicostomy) often brings most gratifying clinical results. As a rule, the general practitioner pays too scant attention to the condition of the teeth, and it is true that proper dental conditions very often bring about an improvement of digestion and in this way improve the status of general health. It is also most probable that the minimizing of the element of swallowed infectious material when the hygiene of the mouth has been cared for has much to do with this.

The noting of the breath is a clinical observance of no mean importance. It must not be considered an inelegant or dangerous procedure on the part of physicians to be deliberate in this way. In this connection, I personally feel that we may learn much from the older clinicians who, in their work, depended more upon impressions upon the fine senses than is done to-day with the more modern methods of examination at our command. Among the observations I have made are that a sweetish breath is commonly observed in diabetes mellitus and occasionally in chlorosis, and that in the first mentioned when an acid intoxication exists this quality of the breath is most marked (fruity). In septicemia a somewhat the same odor exists which may be described as less pronounced (in many cases, however, no change from the normal can be noted). A urinous odor is found in uremia, and the offensive odor following the abuse of alcoholic drinks is well known.

An offensive breath is observed in some cases of constipation where there is much fermentato-putrefaction in the gut; in diverticulum or other retention conditions of the esophagus; in some cases of gastric atony when stagnation with sulphurated hydrogen production is present; in cystitis with ammoniacal decomposition of the urine; with plugs in the crypts of the tonsils; in carcinoma of the tonsils, pharynx, and larynx; and in the serious lung conditions, namely, phthisis with cavities, pulmonary abscess, and gangrene. Lastly may be mentioned the ulcerative and inflammatory conditions about the mouth, and neglect of dental conditions and hygiene of the oral cavity.

The important point in the treatment of offensive breath is to determine and remove the cause. There are, however, many instances of persistent offensive breath for which a definite cause cannot be assigned. In these unfortunate individuals (most of whom in my experience have been women) I believe the condition to have an intestinal origin, and the foul breath due to an adventitious or incomplete resorption of the [illegible] substances from the bowel and their elimination from the [illegible] air. I [illegible]

a number of occasions that when there was a congestive or catarrhal degree of inflammatory process in the gut a foul breath was often present. For instance, in women who are about to or who are menstruating at the time, a temporary foul breath may exist, and this is probably due to the congestive condition in the pelvis and lower abdomen incident to the process and creating a higher status of resorption. In the persistent form of offensive breath when no other cause can be assigned, I have noted that the best results come from the use twice weekly of oleum ricini, a lowering in the proteid foods, the steady administration of a gentle laxative or daily irrigations of the colon, and the drinking of considerable water between meals. After all meals the mouth should be thoroughly rinsed with plain warm water or an antiseptic mouth-wash, and the use of the following formula of Miller's may be of service:—

℞ Acidi benzoici	6.0	ʒiss
Ol. menthæ pip.	1.0	♏xv
Tr. eucalypti	30.0	f℥j
Alcohol. absol.	100.0	f℥iiiss

Fiat et Sig.: Use night and morning as a mouth-wash, using a toothbrush to cleanse the teeth.

Changes in the lips possess a clinical significance in several important ways. In health the lips are naturally of a bright red color, often observed deepest at the margin of contact. They are observed abnormally pale (also the oral mucosa) in anemia, hemorrhage, chronic parenchymatous nephritis, and in aortic stenosis. While this pallor is of value as a clinical sign in the diagnosis of anemia, it must not be forgotten that a rather deep red color to the lips may exist with an anemia present; although usually in these instances the vault of the mouth and fauces mucosa are paler than normal. In this connection a word may be added as to the diagnostic value of the color of the tarsal conjunctiva. When the lids are free from local disease (trachoma, folliculitis, acute catarrhal process), this sign is of some clinical service, but these local conditions are so common, particularly among the poor, that but little dependence can be placed on the depth of color (the lower lids being the ones usually observed are also the ones most often affected). In cancer of the alimentary tract and in diabetes a deep red color to the lips is occasionally seen; and in jaundice a yellow tinge to the inner surface of the lips and buccal mucosa is the rule. Deposits of lead in the lower lip with a blue line [illegible] gingival margins may be noted in chronic lead poisoning, and [illegible]'s disease the presence of brown patches on the lips, inside [illegible] and palate is a most important diagnostic sign. [illegible]ps may be observed in pneumonia, emphysema, in

congenital and acquired heart disease, mediastinal tumors, rupture of an aneurism into the superior vena cava, polycythemia, intestinal toxemia, and in poisoning with coal-tar products. Riesman mentions a case of enterocolitis in which enterogenic cyanosis was always preceded and accompanied by intense blueness of the lips. Among the other conditions concerning the lips may be mentioned the vesicles of herpes seen in infectious colds (influenza, streptococcus infections), lobar pneumonia, malaria, angioma, carcinoma and lymphangioma; and Baelz's disease, which is a chronic inflammation of the mucous glands accompanied with ulceration and enlargement of the lymph-glands and constitutional symptoms (the latter disease is most probably infectious in nature and rapidly responds to topical applications of tincture of iodine to the ulcers).

Among the disturbances of sensation of the tongue and mouth may be mentioned anesthesia, hyperesthesia and paresthesia and ageusia.

Anesthesia is usually of hysterical origin, extends into all qualities of disturbed sensations, is usually unilateral but may be complete. When a lesion exists in the inferior maxillary nerve, the tympanic plexus, or cerebrum accounting for its presence it is always unilateral, and when of central origin is generally part of a hemianesthesia (one-half of the body). Hyperesthesia is more commonly encountered in the various forms of local inflammatory processes in the mouth, and paresthesia (pricking, tingling, formication), in the general neurological affections. Of the latter may be mentioned particularly hysteria, central lesions of the nervous system such as apoplexy, and more often in neurasthenia and psychasthenia. Ageusia is to be expected in dryness of the mouth, such as with typhoid tongue and mouth breathing. In ageusia limited to the anterior one-third of the tongue, the lingual nerve or the chorda tympani is involved. In general anesthesia of the mouth, ageusia may also be present, and in hyperesthesia a hyperageusia is the rule; the latter conditions are found in most complete form in hysteria. In this disorder, in the insane, as an aura in epilepsy, in some cases of facial palsy from chronic ear disease, and in digestive disturbances, parageusia (gustatory in origin) may exist. In the digestive disorders, sweet, metallic, salty and bitter tastes are commonly complained of. Many of these no doubt have a reflex origin, although local conditions in the mouth and the taste of eructative discharges from the stomach account for many of them.

Of the inflammatory conditions about the mouth (stomatitis) may be mentioned the catarrhal, aphthous, ulcerative, specific infective, and the gangrenous forms.

The catarrhal cases are most commonly met with in clinical work. There is usually seen a redness and swelling of the mucous membrane, accompanied with an increase of saliva and bacteria and an offensive breath. The condition is most often local in its nature, although it is found as an accompaniment of the infectious diseases (scarlet fever, influenza, measles, variola), in digestive disorders and low states of the general system, and after the use of certain drugs (mercury, iodides, lead, arsenic, etc.). The local conditions in which it is seen are the results of taking irritating foods, drinks, and medicines, in tobacco users, in abnormal dental conditions, and in those who do not take hygienic care of the mouth. The removal of the cause, the thorough cleansing of the mouth after meals, and the use of an antiseptic mouth-wash or rinsing the mouth with a weak solution of glycerite of tannin (1 teaspoonful to ½ a glass of warm water) usually corrects the condition in a short time.

Aphthous stomatitis is more particularly met with in children during the stage of first dentition. Usually in only small areas of involvement the condition is seen in adults for about the same reasons as are mentioned in the catarrhal form. Most of the laity believe that the condition is due to some digestive disorder and in this I also concur. My reasons for this are that as yet no specific organisms have been found in the cream-white adherent or more or less detached plates of mucous membrane and small round discrete ulcers, and that purging the patient and correcting an intestinal disorder are as necessary in the treatment of marked cases to cure the conditions as are the local treatments. The ulcers are usually small with a slightly elevated red border and are found in the inner and lower surface of the lips, in the labiogingival pouch, the under surface or at the tip or margins of the tongue, and are usually most exquisitely painful for their small size. Salivation from mouth irritation is generally present, the tongue is coated, the breath is offensive and a slight degree of fever may be present. The treatment consists of drying, cocainizing and thoroughly touching the spots with a stick of solid silver nitrate, and the correction of such general or digestive disturbance as may be present; for the latter a dose of oleum ricini followed by tablespoonful doses of mistura rhei et sodæ after meals are valuable; often the general tonics are also of service.

Ulcerative stomatitis (putrid sore mouth) is the term given to those conditions in which the general state of the mouth is more severe than in the above in that the ulceration is a more prominent feature. The ulceration, however, is more on the confluent order, and usually begins in the gums at the dental margins. The entire

extent of gums becomes involved, swells, bleeds easily, ulcerates, and necroses. The ulceration may eventually extend over to the lips and buccal surface of the cheeks. Salivation is profuse, and the breath most offensive. Mastication is painful, the sense of taste is impaired, there may be fever, and from interference with the taking of food, some emaciation. The condition lasts for from a few days to several weeks, is not fatal in nature, and responds well to treatment. Etiologically speaking, no specific cause has been ascribed for the condition. My belief is that a general cause, such as scurvy and other blood dyscrasias, salivation from mercury (ulcers here are usually on the buccal side of the cheeks opposite the molars), pneumonia, chronic nephritis, hepatic cirrhosis, etc., render the mucosa and tissues of the mouth liable to marked local infections from the mouth bacteria. The fusiform bacillus of Vincent (anaerobic) and the spirochetes are most often associated with the condition. The treatment consists of the use of the stronger antiseptic washes (hydrogen peroxide, weak phenol solutions) and the topical use of a silver nitrate solution or tincture of iodine. The general condition of the body should receive proper attention, and such cases as develop in hospitals or institutions (usually children in an asylum) require better hygienic conditions. In the case of mercurial stomatitis the administration of the drug should be stopped, tonics given for the time being, and a mouth-wash prescribed.

Gangrenous stomatitis (noma, cancrum oris) while formerly quite common is rarely met with to-day. It is most often seen in children following the infectious, contagious and communicable diseases, and is most probably due, like the above, to a combination of reduced general health and mouth infection. The process is usually located in the cheek or lip, and manifests its presence by the integument over the area becoming swollen, glazed, colorless, and hyperesthetic. Following this an ulcer appears on the mucous surface which rapidly becomes gangrenous and advances outward to the integument. In severe cases the tongue and palate may become affected. The odor is most fetid, and the submaxillary lymph-glands are usually enlarged from toxic absorption. The treatment is essentially surgical and antiseptic, to which stimulation, high feeding, abundance of fresh air, and tonics are required. Generally the younger the child and the more extensive the involvement the more fatal is the issue, most of the cases dying from exhaustion emaciation or end infections.

Among the other conditions of the mouth are thirst, herpes buccalis, glossitis, Riggs's disease, gonorrheal stomatitis, tuberculosis, carcinoma, actinomycosis, cysts, lupus erythematosus, urticaria, syph-

ilis, the mouth lesions of lichen planus, pemphigus, eczema seborrheicum, erysipelas, and scleroderma. The oïdium albicans, the etiological organism in thrush, is easily observed by examining a bit of the infected membrane microscopically, when the two forms of the organism will be seen as small, yeast-like bodies (spores) and long, branching, band-like formations which present distinct segments (fungus); drying, fixing and staining of the specimen are not required. In herpes the vesicles are usually on the outer surface of the gums, on the dorsum or under the tongue. In searching for the specific organisms of the other infectious conditions it may be advised in cases of lupus to search for the tubercle bacillus in the diseased tissue or deep scrapings of the ulcers; and in actinomycosis, in the contents of the typical kernels which must be opened for the purpose. In Vincent's angina smears from the exudate (dried, fixed, and stained with carbol fuchsin 1 to 20, Löffler's blue and gentian-aniline water) show these as spirilla usually presenting 3 or 4 convolutions—in fresh wet-stained specimens they are actively motile—and a fusiform bacillus (non-motile). The same organisms may be found in normal individuals and other mouth conditions than Vincent's angina, but not in such large numbers. A more extended description of the common bacteria of the mouth is found in Chapter II.

DISEASES OF THE SALIVARY GLANDS.

Glucose in the saliva is found present in about one-half of the cases of diabetes mellitus, and in grave forms of nephritis and uremia urea in increased amounts is even more commonly found. What concerns us particularly here are the distinct conditions pertaining to the salivary glands and their secretions, as these have a direct bearing on digestive disorders.

Conditions of hyperptyalism are by far more often diagnosed than hypoptyalism or even aptyalism. The reason for this is that in the first mentioned the patient usually draws attention to the excess secretion, while in the diminished and also the absence of secretion direct examination is usually called for. Among the conditions in which an increased secretion of saliva is noted are the inflammatory mouth disorders, already described, and dentition; as a reflex in excess gastric juice secretions (hyperchlorhydria, gastric ulcer), trigeminal neuralgia and pregnancy; from direct stimulation, such as in hysterical and neurotic salivation; and from drugs, such as mercury and pilocarpine.

While not a convert to the latest fad for the cure or prevention

of digestive disorders (the so-called Fletcherism), I wish, however, to state that enough attention to the subject of thorough insalivation of foods and tests for the amylolytic power of saliva has not been paid by the general medical public in the care of digestive disorders. Considering the subject from the standpoint of gastric digestion, gastric distress can ensue from what may be termed a relative hypoptyalism —that is, where the salivary secretions are normal, but from hasty eating only small amounts of the secretion reaches the stomach and thus a too low conversion of the starches takes place in the fundic and axis areas of food in the stomach. The starches make up a large bulk of our foods, and unless enough conversion takes place before saturation with the hydrochloric-enzymotic secretions (which inhibits its digestion) *bona fide* fermentative states with excess gas formation are liable to occur. Following this long standing habit, the salivary glands (from lack of function) to a practical extent lose their full secreting or functioning power, and for this reason the subject and the digestive power tests of the saliva are important.

Rather commonly in neurasthenia, psychasthenia and other general neurotic disturbances of the functional forms, a hypoptyalism exists. In fright, suspense, worry, grief and anxiety, the salivary secretion may also run low with or without a corresponding change in the hydrochloric acid secretion of the stomach. The therapeutic indication is logical here, namely, measures for the correction of the nervous disorder, more thorough chewing of the foods, the taking of less fluids with the meals, possibly the partaking of less starches, and the short time use after the meal of the common forms of chewing gum. Care must be taken when advising the employment of the latter that a prescribed limit of time for its use be laid down, because patients are liable to become habituated to its use, and chewing it between meals with the swallowing of much saliva into the empty organ often causes a degree of anorexia and the institution of a general gastric distress. Diminished salivary secretion occurs in connection with the infections or continued fevers (pneumonia, typhoid) which deprive the body of its fluids, and likewise in diarrhea, pyuria, and tapping of dropsical accumulations. Hypoptyalism is not uncommon in arteriosclerosis, and an aptyalism is to be expected in those rare cases of atrophy of the salivary glands. Under the name of xerostomia (dry mouth) Hutchinson has drawn attention to a distressing continued dryness due to suppression of the salivary secretion, which condition is most probably caused by a neurotic disturbance. These cases usually resist treatment, often recover in the course of time, but when true atrophy of the salivary glands has taken place

may go on to a fatal issue. A case of this kind I had under observation some years ago in a man 41 years of age finally recovered on large doses of strychnia, kept up over two months of time, daily hot baths and being kept constantly in a nearby health resort.

True atrophy of the salivary glands is a rare disease. More or less senile atrophy occurs in advancing age, but there is an atrophy of obscure origin which may affect any one or all of the salivary glands in middle age. The condition is observed by an unnatural smoothness of the floor of the mouth, a hollowing and wrinkling of the integument over the site of the parotid glands, and the complaint of excessively dry mouth. On the other hand, a symmetrical enlargement of the lacrimal and salivary glands (Mikulicz's disease) may exist with little or no effect on their secretions. The condition is probably not a clinical entity but due to a lymphoid hyperplasia from general toxic, infectious (tuberculosis), or a blood-dyscrasia (leukemia, pseudoleukemia, atypical lymphomatosis of a sarcomatous nature) causes. For the treatment of this condition the therapeutic use of the X-rays has been advised (Pfeiffer).

Zagari described a case of functional disturbance of the salivary glands. The patient was a woman, aged 50 years, who suffered from an increasing dryness of the mouth until the secretion of saliva entirely disappeared. The immediate results were, of course, manifest in the processes of mastication, deglutition and articulation. After six or seven months the sense of taste completely disappeared in the anterior one-third of the tongue on both sides. In spite of this, the patient felt strong, had a good appetite, and digested her food normally. Emaciation began to take place slowly, however, in spite of plentiful feeding and the administration of cod-liver oil. On account of a suspicion of syphilis, a specific treatment was tried, but without result. Death followed from marasmus after two years and four months. The author concludes, after clinical observations and experiments on animals, that there is a nucleus salivaris or nucleus gustationis in the upper part of the medulla. A lesion of this center, of a syphilitic or parasyphilitic nature in this case, affected the neuron, which, through the chorda tympani, acted on the salivary glands. The results were lack of salivary secretion because of atrophy of all the salivary glands, parotid, maxillary and sublingual, and loss of the sense of taste on both anterior thirds of the tongue. The increasing emaciation and marasmus were caused by lack of the internal secretion of the salivary glands. That such a lack of internal glandular secretion can cause severe cachexia and degenerations the author states is well known.

Among the other conditions that affect the salivary glands are acute parotitis of an unknown nature, infections (mumps), and the secondary forms from measles, scarlet fever, pneumonia, pyelitis, and abdominal operations; chronic parotitis due to retention of the secretion from stenosis of the duct caused by ascending mouth infection or the formation in the duct or gland of salivary calculi; tuberculosis, a very rare disease (the parotid and pancreas are peculiarly immune to tubercular infections) and when found is always secondary to tuberculosis elsewhere; syphilis also very rare and usually tertiary; salivary calculi in Wharton's duct which may obstruct the tube, causing retention of secretions, swelling and pain, and which stones can usually be felt on buccal examination; the tumors, endotheliomas, sarcomas, mixed adenomas, and benign tumors (ranula); and lastly Ludwig's angina, which is more of a septic cellulitis affecting the floor of the mouth in the submaxillary region and when extending into the throat and larynx is fatal in about one-half of the instances. Of these, the acute inflammations usually care for themselves and for which the regular medical measures suffice; in chronic inflammation effort should be made when no stones are felt to dilate the duct from the mouth side with small, soft elastic bougies—when stones are felt the treatment is surgical; the tumors are surgical affections requiring extirpation; and in Ludwig's angina a free incision over the submaxillary and parallel with the ramus should be made in an effort to stay the advance of inflammation into the throat.

DISEASES OF THE ESOPHAGUS.

Congenital Malformations.—Malformations of the gullet are not very common. Instances have been reported of a congenital stenosis existing at various points down from the pharynx to the cardia, an opening of the upper or lower end of the esophagus into the air passages, and an instance of two gullets existing side by side. These are of embryological origin arising from the fact that the pharynx and esophagus have a common origin and that adventitious formation may occur.

ESOPHAGEAL DIVERTICULA.

The malformation of the gullet that is most often met with is diverticula, which consists of pouches in the wall that connect with the lumen of the viscus. There is still some question as to whether these are congenital in origin, due to defective fusion of the muscle coats of the two sides at the median line posteriorly, and when lateral

PLATE XXVII.

Diverticulum of the esophagus. The anomaly was on the left and about one-third the way down the esophagus. Its diameter readily admitted the tip of the index finger, and extended downward about one inch outside of the gullet. The patient had no knowledge of its presence (it had never given him any symptoms of its existence during life) and it was disclosed at post mortem.

from lack of obliteration of the bronchial clefts, or whether they develop during life from pressure from within, "pressure diverticula," and "traction diverticula" when the force is exerted from without. Pressure diverticula, which make up the great majority of cases seen, are usually found in the posterior wall high in the gullet. They are caused by the separation or rupturing of the muscular fibers, at which site the bolus of food causes a hernial sac to form. The sac usually consists of thickened mucous membrane, submucosa, and fibrous tissue, although a few muscle fasciculi may be present in the wall. They may be single or multiple, small or large in size, and pedunculated with a slit opening or globular with a wide opening. They are more often found in the male in middle or advanced life, and are liable to escape clinical recognition and their presence first be noted at autopsy, although when situated in the thorax, and large in size and under conditions of high intra-esophageal pressure the sac may rupture with serious results, such as aspiration pneumonia, phlegmon secondary to perforation, and perforation into the air passages.

In the traction form, a funnel-shaped diverticulum is usually found anteriorly on a level with the tracheal bifurcation. These often seem to be due to involvement from the large lymph-gland at that site and which commonly is infected with tuberculosis, causing periglandular inflammation.

Symptoms.—The great majority of both pressure and traction diverticula, being small in size, give no symptoms and are not diagnosed during life. If the sac be large enough to hold fluid or food material, its decomposition takes place, local irritation is produced with sternal burning and pain, a constant feeling of a foreign body in the throat may exist, vomiting of the contents of the sac may occur, there may be difficulty in swallowing from pressure of the sac on the gullet, and disturbance in free respiration from pressure on the surrounding tissues without the canal. When retention of foods exists, a foul breath may be noted, and an esophagitis may develop which might result in ulceration and perforation. In this latter instance, a periesophageal abscess may develop and the pus may empty into the gullet with recovery, or into the thoracic cavity causing empyema and gangrene of the lung. A tube and bougie usually pass a small diverticula, and also a large one when the opening is small and the sac is more or less collapsed. When the opening and the sac are large and distended with contents a tube may be diverted into it, its further downward progress be stopped, and the contents of the sac aspirated. The arresting of the tube in the course before its tip has reached the stomach cavity and the aspiration from the sac of decom-

posed fluid or food without stomach secretion in it are the distinctive points in the diagnosing of the condition. If the sac is in the lower pharynx or upper gullet the finger may be used to palpate it; if lower down a bulging may be noted in the lateral aspect of the root of the neck. An esophascope or gastroscope and possibly the X-ray bismuth method of diagnosing may be used for those lower down. Rather than use a stomach tube the second time in a suspicious case (because one is liable to rupture the sac, which occurs easily), these latter measures should be employed.

Treatment.—Small diverticula, when observed, might be left untreated. When they are large enough to cause symptoms, both subjective and objective, they are operable cases. In bad cases feeding through a tube may be practised for a while to build up the patient's strength to withstand the operation which in each instance is liable to be a severe one. Rectal feedings may also be employed. If feeding in the usual way is allowed the foods should be semisolid in nature and not much swallowed at any one time. Regular washing of the esophagus with water assists in preventing the decomposition of food and thus the health and tone of the viscus.

ACUTE ESOPHAGITIS.

Primary inflammations of the esophagus no doubt are a much more frequent condition than is diagnosed. They can occur from mechanical, thermal, or chemical irritation of swallowed substances, of which too hot liquids make up the largest bulk of the cases. The esophagus may be secondarily affected with acute inflammation in inflammatory disease of the mediastinal tissues, from extension of inflammation from the pharynx (rare), as an accompaniment to the various acute diseases, such as diphtheria, scarlatina, variola, measles, typhoid, pyemia, pneumonia, thrush, and in cancer of or near the tube.

According to the severity of the process, the degrees catarrhal, follicular, ulcerative, phlegmonous, and necrotic inflammations are recognized. In the ordinary catarrhal, the mucous membrane is reddened from congestion of the mucosa and submucosa, a slight desquamation may be seen, and there is usually an excess secretion. The follicular, in my opinion, should be considered as a distinctive type of disease in which an inflammation of the lymphoid and mucous glands takes place. The glands involved in the mucoid degeneration are usually the mucous ones in the upper part of the tube, a condition which may result in retention cysts, or when infection and strangulation of the circulation by surrounding inflammation take place, ulcers and perhaps abscesses may ensue.

After the drinking of lye solution or the corrosive poisons large pieces of the mucosa may be shed and brought up in the vomitus. When the action of the poison is slight, roughened areas of membrane may be seen, and when severe a deep slough may take place, leaving a hemorrhagic and inflamed base. In these instances, if death does not occur from shock or the chemical action of the poison, rather extensive esophageal suppuration and ulceration often occur the healing of which is attended with the highest degree of stricture. Ulcers of typhoid fever are occasionally found in the gullet, and in variola discrete, small-sized, suppurative areas may be encountered.

Symptoms.—In the case of the poison the inspection of the mouth and pharynx generally makes the case clear. There is usually severe pain in the course of the gullet with substernal distress made definitely worse upon swallowing. Dysphagia and expectoration of mucus are present and also extreme thirst. In other cases, even severe ones, the pain may be dull, or even not present at all. The main symptom in esophagitis is the increase or the incident of pain in the swallowing of hard, dry foods, or very hot or very cold fluids. The passing of tubes or bougies is distressing and rather dangerous because of perforation or infection. Such symptoms, more or less severe, coming on after the history of a cause for the production of an inflammation or during the course of an infectious disease are always suspicious of an esophagitis. If a foreign body lodged in the canal causes the inflammation, regurgitation of food, blood, and pus may occur. If the involvement be severe and low in the gullet, perforation is liable to take place, with escape of infected fluid into the trachea, bronchus, or chest cavity.

Treatment.—In the severe forms (poisonings) the antidotes and emollient drinks are indicated, and olive oil containing one of the insoluble bismuth salts in suspension may act as an efficient sedative to the inflammations in the milder cases. The dissolving in the mouth of small bits of ice may be tolerated for a short time, and ice bags or hot applications to the stomach, back, or neck may be applied. In poison cases rather than run the risk of perforation by the passing of tubes through the gullet for the purpose of gavage rectal feedings should be employed, and in severe cases a gastrostomy may be required. In the slight forms but little treatment is necessary, and bland fluid or semifluid foods should be employed until the condition corrects itself, which is usually in a few days. About 0.03 gramme of cocaine or 0.06 gramme of eucaine in solution may be used to relieve the distress and induce more comfortable swallowing. The main indications are physiological rest of the esophagus and sedative measures. For the

first 2 or 3 days the matter of feeding is not important. In severe cases a hypodermic dose of morphia may be called for to relieve the distress and nervousness.

CHRONIC ESOPHAGITIS.

This type of esophagitis is most commonly seen in chronic alcoholics, and as a result from repeated congestions brought on by disease of the heart or lungs. It is not uncommon to find more or less chronic superficial change in the lower part of the gullet in long standing cases of chronic gastritis or in the excess gastric secretions; this is particularly so when vomiting or regurgitation of foods have been long-standing features. Recurring acute inflammations may bring on chronic change, and the condition is noted as a secondary change to esophageal cancer, ruptured diverticula, and dilatation of the tube.

Usually the condition is observed as grayish streaks of degenerated epithelium on the summits of the longitudinal folds with an increase of mucus in the tube. Occasionally, the color of the esophageal mucous membrane is a dusky red or bluish, and the membrane may have a granular appearance resembling that of a chronic granular pharyngitis. Superficial ulceration or rather desquamation in localized areas is often present but must be searched for very diligently.

Symptoms.—These being very indefinite and usually masked by those of disease in other organs the condition can only be suspected during life, and the diagnosis is usually made at autopsy. A history of cause with some uneasiness or difficulty in swallowing and an indistinct sternal distress long persisting after the taking of irritating foods or drink make up the symptoms. Should distinct ulceration or stenosis result the symptoms would be more definite in these directions.

Treatment.—The main indication in the treatment is the removal or improving the condition of the primary cause. Alcohol, pungent foods, tobacco, and hot fluids are to be avoided, and the taking of demulcent drinks and bland foods are advisable. In persistent cases topical application to the esophageal mucosa may be employed. Of these, 1-per-cent. solutions of tannin or silver nitrate delivered (patient prone) by means of small calibered, long, stiff catheter at short intervals up from the cardiac orifice are of value. Bismuth suspended in olive oil may be drunk at intervals during the day, and the rather constant use of the well-known red gum lozenges helps to some extent.

ULCERS OF THE ESOPHAGUS.

More or less ulceration may occur with any of the above, but those forms are not included in this connection. There are instances of esophageal ulcers which from the cause that enters into their production are classed as the decubitus, pressure, uremic, and peptic ulcers. The decubitus ulcers are found in emaciated persons who have suffered from exhausting disease (cachectic states, typhoid fever, and cancerous disease). They are usually shallow and situated at the beginning of the gullet at a level with the cricoid cartilage, and are most probably due to attrition of the opposed walls from emaciation of the protecting soft tissues and resulting pressure of the esophagus between the cartilages of the larynx and bodies of the vertebra when the patient is in the recumbent position. Pressure ulcers are those that occur from the pressure of encroaching growths situated outside of the gullet, causing first a local anemia from compression and then the slough of the dead tissue. Uremic ulcers occur in uremia, in which condition ulceration in the colon may also be met with; the toxemia or possibly thrombosis noted in this condition seems to be the most plausible cause for their production. As a rule, the above types of ulcers give no definite symptoms.

Peptic ulcers are the more common of the 4 forms met with; occurring in about 0.13 per cent. of all autopsies. They occur at any age, are about twice as common in the male as in the female, and are usually situated in the lower part of the gullet and occur under conditions similar to those in which gastric and duodenal ulcers do. The fact that this type of ulcer is also encountered in the stomach and the first part of the duodenum (what may be designated as the area limits of the gastric juice) makes me feel that the gastric juice is directly responsible for their production. Therefore in order that a peptic ulcer be formed in the esophagus it is evidently necessary that the cardia should be insufficient allowing regurgitation of gastric juice into the esophagus, and no doubt a cardiospasm (secondary to an acute esophagitis from the long-standing irritation of gastric juice) could cause retention of the stomach contents and resulting autodigestion of the devitalized mucosa at that point. This I believe is confirmed in the fact that in actual stenosis of the gullet or pylorus, or upward pressure of large abdominal tumors causing kinking of the esophagus, this distinct type of esophageal ulceration is liable to be met with. Alcoholism, arterial sclerosis, and trauma are also predisposing causes.

The simple ulcer of the esophagus resembles very closely both in gross and microscopic appearances the peptic ulcer of the stomach. It usually stops short at the cardia, although it may extend through it into the stomach; in the latter instance the ulcer probably began in the stomach and extended upward by direct extension into the esophagus. In about four-fifths of the cases they are single; in the rest, multiple and very often are present with additional ulceration in the stomach and duodenum. In my opinion, they are as much a factor in the production of cancer of the cardia and gullet as is the same type of ulcer in that of the stomach and pylorus. About 15 per cent. of the cases perforate, which occurs into one or the other pleural cavity (usually the right) and occasionally into both. In other cases the aorta, pericardium or lesser omental cavity may be entered, or the process be confined to the periesophageal tissues and a pericarditis or pleurisy occur from carried infection. Healing takes place frequently with the production of a scar which if small in size and superficial does no especial harm, but if of large size, deep and puckered is liable to produce stenosis.

Symptoms.—In a large proportion of cases the ulcer was not suspected during life; being entirely latent, or not giving rise to symptoms characteristic enough for a diagnosis. In another group it remains latent up to the time of perforation. The most important symptom of an open ulcer is pain in the region of the ensiform cartilage or beneath the sternum radiating to the back between the scapulæ. This is usually made worse in the act of swallowing or immediately afterward; in that way it is sooner in its production than gastric or duodenal ulcers. Dysphagia, probably produced by spasm, and hemorrhage are present in about one-half of the cases. The site of the bleeding may be learned by having the patient swallow about two feet of No. 15 braided surgeon's silk and (after tying the outer end to the ear, or securing it with a strip of plaster at the angle of the mouth) leave it in the esophagus for several hours; after this it is withdrawn, and the distance down from the mouth that the blood deposit is noted will give the position of the hemorrhage. In these instances the presence of blood may be noted in the stools. As a rule, vomiting is not present.

When perforation occurs the case quickly takes on a fatal aspect with sudden intense thoracic pain, dyspnea and collapse, and the physical signs of pneumothorax or hydrothorax. When the perforation is low and emptying below the diaphragm a localized peritonitis in the lesser peritoneal cavity can occur with the gradual onset of pain, dysphagia, and the symptoms common to perforating gastric ulcer.

The **prognosis** in the average case is always most uncertain, with that of perforation and severe hemorrhage grave. The healed ulcer is very liable to develop a stenosis, and the possibility of remote malignant disease should be thought of. The occurrence of an esophageal ulceration as a complication of grave diseases seriously shortens the chances of recovery.

Treatment.—This is practically that indicated in a severe degree of acute esophagitis and gastric ulcer combined. No foods should be allowed by mouth and rectal feedings employed for the time being. In hemorrhage a few drops of adrenaline chloride solution delivered into the mouth by means of a pipette may be of service. The ergot preparations are of no value. If after a few days the case takes on a favorable aspect, it should be treated like that of gastric ulcer by rest in bed, a fluid proteid diet (Leube cure), with bismuth, belladonna, and the external applications of cold or heat whichever is the more grateful in affording relief. Instruments should not be employed, the danger of perforation, hemorrhage, and infection by their use being too great. In a favorable case after a few weeks the gentle and occasional use of esophageal bougies to prevent stenosis would be indicated. When recurrent hemorrhages are a feature or atresia eventually occurs a gastrostomy should be performed as early as possible. The cases of perforation are particularly fatal, in which surgery, because of the inaccessibility of the gullet, up to this time has been of little help. Should, however, the symptoms be mostly of the abdominal order, the upper abdomen should be opened as early as possible, the perforation searched for, drainage established and the operation finished with a gastrostomy.

STRICTURE OF THE ESOPHAGUS.

These may be divided into the non-malignant (cicatricial), malignant (cancer), and the spasms (esophageal, cardiospasm). The latter will be found described under the motor neuroses. The congenital stricture, usually found in the upper part of the gullet, is generally only mucous and submucous in origin, the other structures being normal in make-up and size.

The fibrous stenoses take their origin from inflammation or ulceration in which the loss of tissue is great enough so that in its repair an extent of scar tissue formation occurs the stiffness and contraction of which permanently narrow the lumen of the canal. The causes that enter into the majority of the cases seen are the scar-tissue results from ulceration due to the corrosive poisons, healed typhoid,

the tuberculosis or peptic ulcers, and gumma. The more concentrated the corrosive poison (usually a lye solution taken accidentally) the greater is the danger of a quickly developing stenosis. If only a few drops had been swallowed, or the solution was not a concentrated one, or a low degree of caustic or irritating poison had been taken, there may be very little dysphagia, a quick recovery with an apparently patent gullet, and finally a slow stenosis of greater or lesser degree occurring months later; for this reason one should always be on guard in giving a good prognosis until at least several months have elapsed and after the bougies had been passed. The sites where stricture is most likely to occur are at the natural narrowings where the corrosive or burning material delays, *i.e.*, the cricoid, the tracheal bifurcation, and the diaphragm. A stenosis, however, can take place at any point between these, and when once established a moderate degree of dilatation is usually present above it.

Symptoms.—In the average case the first indication of the condition is a difficulty in swallowing not accompanied with any actual pain. This is noted more particularly when solid food had been ingested, and later on with the semisolid, and finally in severe degrees of stenosis with the fluids. The food that does not pass through is regurgitated after a variable time; when much dilatation is present above the stricture this is usually somewhat delayed. The regurgitated foods are free from HCl and the stomach enzymes. As a rule, patients soon learn their swallowing capacity, choose such foods which in consistency easily passes the stenosis, and altogether take all kinds of food very slowly and in small quantities at a time. When the food remains lodged in the gullet a "sticking" or full sensation is referred to the top of the sternum. The second swallowing sound is commonly delayed beyond ten seconds, and may not be heard for nearly a minute; in other cases again so little fluid comes through the cardia that it trickles down the side walls of the stomach, and this sound is absent, or may be rather indistinctly continued over a length of time. The swallowing sign of Revidtzev may be present. The diagnosis is usually confirmed by the obstruction offered to the passage of esophageal bougies (usually supplied in different sizes of olives and six in number) or a stomach-tube. In the use of the bougies begin with the third olive and in successive trials proceed to the smaller or larger ones until the largest that passes has been noted. Since there is danger of perforation only a slight degree of pressure to overcome the spasm that usually coexists and the irregularities should be exerted. Sometimes a bougie will pass one stricture only to meet with a smaller one lower down. In the

absence of treatment, loss of weight from malnutrition is generally observed, and this, because of the mental anxiety attendant on the dysphagia, may be seen in strictures even of a large caliber. In severe degrees of stricture an X-ray observation is most helpful; the negative should be made with the patient standing and immediately after swallowing the bismuth suspension, the plate being placed at the rear.

The **diagnosis** rests between cicatricial stenosis and that due to malignant disease, polyps, external pressure tumors, and spasm. Aneurism should always be thought of, and it must be remembered that foreign bodies may lodge in the esophagus for a long time. Esophascopy when carefully performed and under general anesthesia may be most helpful in the differential diagnosis. The prognosis depends upon the degree and extent of strictured area, and the fact as to whether regular dilatation is possible and feeding can be continued. Usually the younger the patient and the earlier the treatment is begun the better is the prognosis. For these reasons, poison and ulcer cases should be observed for some months after recovery.

Treatment.—In slight and sometimes in moderate cases the use of foods proper in consistency and regular dilatations answers for the purpose of keeping the patients comfortable. The foods should be fluid or semifluid in character so that the element of retention is eliminated as much as possible. This usually means that less sacculation occurs above the stricture, less decomposition of foods in the gullet takes place, and thus less are the factors of spasm and subjective distress. The largest sized olive or sound should be passed at regular intervals, first daily, then every second day, then twice a week, and following this as may be necessary to keep the patient comfortable; the taking of a tablespoonful of olive oil before the dilatations is often helpful, first, in rendering this more expeditious and efficient, and secondly, to minimize the danger of perforation. Rapid dilatation and rough handling of the sound or bougie are dangerous, and the sound should be left in for 10 minutes or more at each treatment.

If it is apparent that such measures are unavailing, operation is indicated. This is also the case in the instances in which only a small sound can be passed or when evidences of malnutrition are developing. For a short time in passable strictures the use of esophageal galvanism may be employed. The next largest ball to that which passes should be used on the electrode, and with a plate below the patient (gluteal region), the current should be turned on and maintained for about five minutes. As high as 100 milliampères of current should be used with the negative pole internal. This treat-

ment was successful in one of the author's cases. In some cases in which malnutrition is well advanced, the strength of the patient can be worked up for operation by gavage through a long enough catheter to reach the stomach. When this cannot be accomplished the chances on an operation should be taken at once rather than to resort to rectal feedings for a length of time. The string-cutting method of operation (Abbe's), including a terminal gastrostomy and followed by regular daily dilatations, is the choice of operation; a gastrostomy should always be done, because in the failure of the method for enlarging the gullet a second operation would not be necessary, and if these succeed the repair of the gastrostomy channel is not a serious operative procedure later on. When the stenosis is marked, the performing of a gastrostomy for the purpose of permanent feeding is in order, an esophagostomy being not so easily performed and less rational. Various other methods of treatment have been devised. The use of strongly built rubber inflating bags covered with fine silk or cotton cloth and attached to the end of stiff tubes, and mechanical instruments having a set of jaws which are separated with a screw from above have been employed in place of the gum-elastic bougie and the whalebone staff with ivory tips. Recovery has been reported by the use of specially devised cutting instruments manipulated through an esophagoscope. Thiosinamin (0.06 to 0.12 gramme) has been used hypodermically every 2 or 3 days with apparent success for the purpose of softening the stricture so that the dilating instruments could be passed.

CARCINOMA OF THE ESOPHAGUS.

Cancer, the most important disease of the esophagus, may occur in any part of the tube causing stenosis with infiltration into the neighboring structures. Statistics from various sources as to the relative frequency of esophageal cancer with cancer of the other organs show these to be from 9 to 32 per cent. of all cases. The figures possible to be obtained in this country and Great Britain show cancer of the gullet to be only slightly lower than that of the stomach, but those from Russia report the esophagus to be the seat of this disease in more than 32 per cent. of all carcinoma cases; it is probable, as McCrea suggests, that, in using autopsy figures, cancer of the breast and uterus, which are comparatively accessible and admit of surgical treatment, show a frequency of occurrence far below their real position, and thus those of esophageal cancer seem relatively high.

The disease is more often found in the male, and usually encountered between the ages of 40 and 60 years. Until the etiological fac-

tor producing cancer is known its direct cause remains covered, but it is most probable that among the important predisposing factors are ulcers more or less healed and which subsequently become irritated, traction diverticula, trauma from foods, and chronic esophagitis, particularly that form found in alcohol drinkers.

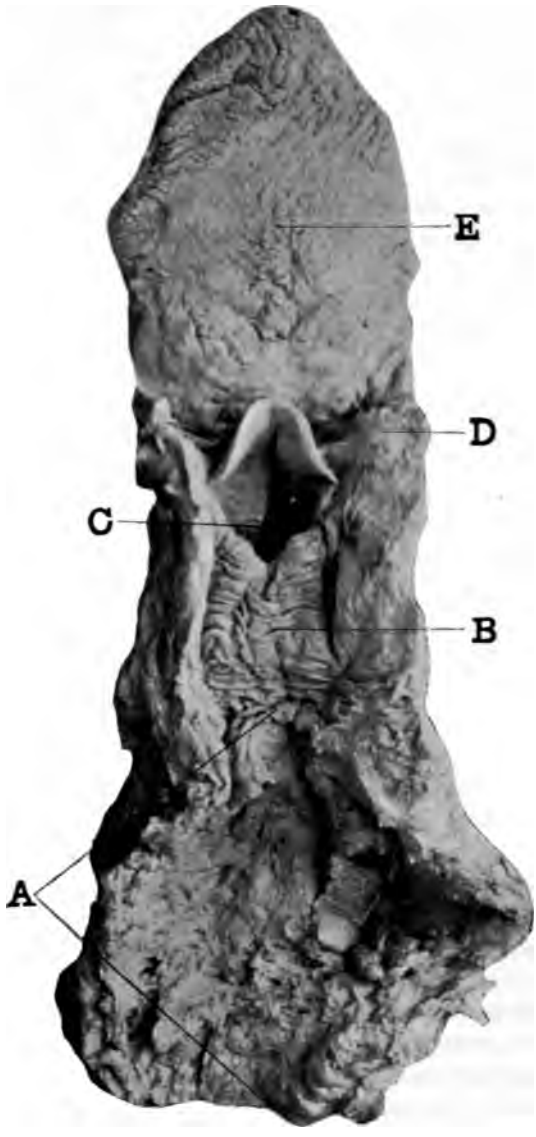
Most of the esophageal carcinomas are squamous-celled epitheliomata arising from the flat-celled mucosa that lines the tube or adenocarcinomata taking their origin from the glands scattered throughout the viscus. Therefore most of the cases seen are undoubtedly primary in nature, and when extension into the gullet from the cardia or thyroid gland has occurred the growth is usually of the same nature as the original neoplasm. In appearance with the tube laid open the growth is usually about 8 millimeters in extent, encircles the tube, is shaggy in appearance, gray or yellowish-white in color, and rather soft in feel. In other instances such a growth may involve the tube in a more or less general way covering a great area, or may be quite localized in the anterior wall. A soft fungating, irregular, cauliflower-like mass with more or less ulceration and hemorrhagic areas is the less common form seen. When the growth is more or less localized a dilatation is usually observed in the canal above it. This is formed by the outward pressure of food lodging at the strictured point, without there having been sufficient time for an effectual hypertrophy of muscularis to take place to cope with it. In late cases, perforation is very liable to occur with extension into the air passages, pleura, lung, pericardium, mediastinum, or blood-vessels. Extension of the growth into the surrounding tissues is the rule. The nearby large arteries and veins, the vagus and sympathetic, and the recurrent laryngeal nerve are generally found involved in the autopsy cases, and with left-sided extensions the thoracic duct and the brachial plexus are also included. The vertebræ may be eroded, and the large veins thrombosed. If the growth is low down near or at the cardia, extension into the peritoneum, diaphragm, and left pleural cavity and lung are usually seen. Metastases in the deep cervical glands are observed in the majority of instances.

Symptoms.—In a person over the age of 40, in whom there is no history of cause such as might produce cicatricial stricture, who gradually develops *bona fide* difficulty in swallowing solid foods, and a stenosis exists, the odds are overwhelmingly great that its nature is carcinomatous. The beginning symptoms are usually those of stenosis described in connection with stricture of the esophagus. As the growth extends, however, a more marked degree of obstruction is observed extending finally to inability to swallow fluids. Regurgita-

tion is common and the higher in the gullet the growth is situated the sooner after ingestion it occurs, particularly if coughing is excited in the effort of swallowing. When the involvement is in the lower third of the tube a severe retching commonly precedes the regurgitation, and rather large quantities of alkaline food, more or less decomposed and showing no stomach secretions are seen. The admixture of blood and pus are also noted when ulceration is present, and under these circumstances the breath is usually fetid. In a few cases dysphagia and regurgitation are not encountered or are very little of a feature; they may be so even if the sounding of the caliber of the gullet by means of bougies and the clinical course of the case plainly suggests the condition. In one of my cases of the latter an extension into the base of the left lung (consolidation noted behind and irregularly running from the vertebral edge toward the axilla) was the first clue as to the presence of the disease (in this instance the autopsy proved that the growth began at the cardia).

A constant feeling of pressure under the sternum with or without actual pain is common. Late in the case when the pains are severe they are usually lancinating, mostly nocturnal, and noted after the patient has been in a prone position for a while. They may be confined to the location of the growth or referred to the xiphoid region, or radiating behind and into the neck and shoulders; in these instances the pains are independent of the taking of foods. The cervical and supraclavicular glands when enlarged are palpable, especially those on the left side, and from extension of the malignant growth into the carotids, subclavians, or intercostals, or veins, a general carcinomatosis may occur with metastatic deposits in the integument. With the involvement of the recurrent laryngeals there may be a very serious dyspnea, and a hoarse, brassy voice from paralysis of one vocal cord. The latter is the most constant early symptom next to difficulty in swallowing, and, in fact, cases are seen in which dysphagia is not much of a feature and in which the examination of the larynx may give the first important clue to the condition; particularly is this so in left-sided growths. From pressure on the sympathetic, usually by nodes, there may be contraction of the corresponding pupil, with ptosis, falling in of the bulbus, and sluggish reaction to light (Hitzig). Distinct evidence of pressure upon the sympathetic is less often noted than pressure upon the recurrent laryngeals. From the difficulty of taking food and the ravages of the disease there is a rapid loss in weight and strength. Hunger is but rarely present, but constant thirst is common. Cachexia and severe anemia finally develop. The feces may give positive blood-tests. The duration of the disease

PLATE XXVIII.



Stenosing carcinoma of the esophagus. *A*, Upper and lower limits of the malignant growth, esophagus laid open. *B*, Uninvolved portion of the esophagus. *C*, Vault of the larynx, epiglottis above, arytenoid cartilages below. *D*, Tip of the hyoid bone. *E*, Dorsum of the tongue.

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'd be used to locate the site of the stenosis and
if possible the area of stenosis. The first is
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.ı the obstruction is met with, then using a stom-
.ıoting the distance down of the laryngo-pharyngeal
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geal wall), and the difference in distance between the two
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After this the stomach-tube is passed into the esophagus to
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a suction is exerted, and the tube quickly withdrawn. Such
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inzsburg reagent. Care must be taken in these examinations
ɔo great a degree of force is not exerted, remembering always
ıe danger of hemorrhage and perforation is great. In marked
a radiograph showing the presence of stenosis, or in the less
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:ing an early diagnosis. By it the growth can actually be seen,
; nature and the stenosis site accurately noted. When carefully
med under a general anesthesia there is less danger in its
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examination of detached fragments. Its course and treatment
:ntical with carcinoma.

reatment.—An early diagnosis made by first suspecting the
ility of cancer being the cause of the stenosis and then determin-

varies from a few months to a year or two, death usually occurring from inanition, perforation, or hemorrhage.

As soon as the difficulty in swallowing has called attention to the possibility of stenosis of the esophagus, a local examination must be made. Bougies should be used to locate the site of the stenosis and measure its caliber, and if possible the area of stenosis. The first is easily accomplished by marking on the stem the distance down from the incisor teeth that the obstruction is met with, then using a stomach tube and noting the distance down of the laryngo-pharyngeal junction (first obstruction to the tube after passing the posterior pharyngeal wall), and the difference in distance between the two represents the site of the obstruction below the beginning of the gullet. After this the stomach-tube is passed into the esophagus to the obstruction, an aspirating bulb is attached to its end by means of which a suction is exerted, and the tube quickly withdrawn. Such contents as are gained (usually only a small amount) are then examined for tissue particles, blood, pus, food, mucus and finally for HCl by the Günzsburg reagent. Care must be taken in these examinations that too great a degree of force is not exerted, remembering always that the danger of hemorrhage and perforation is great. In marked cases a radiograph showing the presence of stenosis, or in the less advanced cases an esophascopic observation are of the utmost value in the diagnostic way. The latter really offers the only positive means of making an early diagnosis. By it the growth can actually be seen, and its nature and the stenosis site accurately noted. When carefully performed under a general anesthesia there is less danger in its employment than the blind use of the other instruments and by means of the special instruments devised for the purpose, and pieces of the new-growth tissues for examination can readily be obtained.

The differential diagnosis rests between extra-esophageal growths which may cause a pressure stenosis of the gullet and possibly also paralysis of the recurrent laryngeal (aneurism of the arch of the aorta, mediastinal tumors, large tubercular glands in the mediastinum and laryngeal tuberculosis), and the various esophageal conditions, particularly the benign stenoses due to the cicatricial deposits and cardiospasm and foreign bodies lodged in the gullet. Sarcoma of the esophagus, an exceedingly rare disease, cannot be differentiated from the commoner neoplasm during life, save by microscopic examination of detached fragments. Its course and treatment are identical with carcinoma.

Treatment.—An early diagnosis made by first suspecting the possibility of cancer being the cause of the stenosis and then determin-

ing this by an examination through one of the endoscopic instruments used for the purpose and the quick performing of an excision surgical procedure offers the only possibility of cure. Because of the impossibility of complete excision of the growth by means of the esophascope, the chest cavity must be entered and the chances taken in doing a resection of a portion of the gullet followed by a gastrostomy. The performing of this is always a most serious matter, but recent advance in chest surgery has now made it possible to reach the mediastinal tissues, and if the case seems to warrant the performing of the operation it should be advised. In the palliative treatment the first indication is to maintain nutrition, and when dysphagia exists the performing of a gastrostomy should be resorted to at the earliest moment; in this way the life of the patient may be prolonged and the subjective symptoms minimized in severity. In the absence of these a fluid diet is advisable and the nutrition assisted by means of night and morning rectal feedings. Short tubes extending from below the strictured area to the back of the mouth and held in place by means of 2 strings which are fastened around the ears may be helpful in prolonging feeding by mouth; the use of such tubes is particulary helpful when perforation into the respiratory tract has taken place (suffocation and insufflation pneumonia from the food). Ten drops of a 2-per-cent. solution of cocaine, or about 20 of a 3-per-cent. solution of eucaine taken just before the ingestion of foods may relieve the distress incident to swallowing. If sacculation of the gullet above the stricture exists, a morning and night lavage of the esophagus with a solution of bicarbonate of soda into which about 20 drops of tincture of nux vomica had been dissolved, or a 1 to 1000 silver nitrate solution may be helpful. A hypodermic of morphine before retiring for the night is often necessary to insure freedom from the nocturnal pains and permit of sleeping. Where there is dysphagia with pain and general restlessness I have observed benefit from the occasional use of the following:—

℞ Morphinæ or codeinæ sulphatis..... 4.0 ʒj
Cocainæ hydrochlor.,
Pulv. ipecacuanhæ .....āā 3.0 gr. xlv
Fiat pastels or lozenges no. c.
Sig.: Allow one to dissolve in the mouth about every three hours.

Recently a patient of mine claimed to have less pain and could swallow with less distress by the taking of small sips of olive oil, slightly salted, just before the foods and occasionally during the meal; subsequently meat powder was suspended in it with slight benefit to his nutrition. The external use of the X-rays has been employed

without appreciable benefit. Einhorn reports benefit in the way of retarding the growth by the local use of radium.

NON-MALIGNANT GROWTHS OF THE ESOPHAGUS.

These are rarely met with, and when small in size are usually not suspected during life. The commonest is the fibrous polyp (fibroma) which may be pharyngeal in origin and as it grows hangs down into the esophagus (McCrea). The next in order of frequency are the proliferations of mucosa and submucosa (papilloma) which may exist anywhere in the course of the tube. Myomata, fibromyomata, and lipomata have been reported. Such growths may be single or multiple, are generally soft in character, and may be pedunculated or sessile. When large in size their presence gives symptoms of a constant stenosis of moderate degree in which the classical clinical signs of the other types of stenoses are absent. When situated in the gullet the esophascope offers the best means of diagnosis and also, when pedunculated, their removal by means of a wire snare. The question of the advisability of removing smaller-sized growths depends altogether upon whether they cause symptoms of obstruction or not.

INFECTIOUS GRANULOMATA OF THE ESOPHAGUS.

Syphilis.—Although exceedingly rare, syphilitic gumma in the submucous and muscular layers and shallow luetic ulcers of the mucosa may exist. Many authors deny that syphilis of the esophagus occurs, but there is no reason to sustain this belief. When one considers the structural make-up of the esophageal tissues it must be evident this organ can hardly escape involvement any more than the stomach or intestine could. Syphilis is a disease that can effect any organ or tissue in the human body, and most probably affects the gullet oftener than is suspected. It is logical to understand that a gumma or the characteristic shallow and painless syphilitic ulcers that are seen in manifestations of the disease in the gastro-enteron could exist without the giving of symptoms that would cause suspicion of their presence. Several years ago, I saw at an autopsy on a middle aged male subject who had had syphilis evidences of ulceration and maceration of the esophageal mucosa with a much more severe ulceration in the colon, the stomach being exempt from any areas of thickening in the walls or ulceration of the mucosa. Recently I had under observation a man who gave the history of having a primary syphilitic lesion thirteen months before and who, eight days before I

saw him, suddenly developed difficulty and pain in swallowing. A moderate-sized bougie passed at the time showed the gullet to be patent throughout its entire course, but returned with a slight amount of blood and a few pus cells adhering to the shoulders of the olive. The introduction of the instrument having been easy, he was placed on mercurial inunctions and full-sized doses of potassium iodide, with complete cessation of the esophageal symptoms in six days' time. It is probable that some of the instances of apparent stenosis that have been successfully treated by antisyphilitic remedies were cases of irritative stenosis due to syphilitic gumma in the coats or ulcers in the interior of the gullet. The diagnosis can best be made by the administration of specific remedies (therapeutic diagnosis), and it is advisable to use these remedies for any case of esophageal disease in which a history of syphilis is obtainable or suggested.

Tuberculosis.—Tuberculous disease of the esophagus is rare, but may occur by direct extension of infection from the bronchial lymph-nodes or lungs, or by inoculation by means of swallowed tuberculous sputum. In general miliary tuberculosis deposits may be seen in the viscus. The involvement of the gullet is usually late in the course of the disease when the reduction in general health is marked. For this reason and because definite symptoms referable to the gullet are so masked or are absent, the diagnosis is rarely made during life. Perforation of a tuberculous ulcer into the pleura has occurred (Flexman, Stillman). Instances of actinomycosis, blastomycosis and trichiniasis of the esophagus have been reported. They also are very rare.

RUPTURE OF THE ESOPHAGUS.

In very rare instances spontaneous rupture of the esophagus may occur during severe internal pressure such as retching or vomiting. It is very probable, under ordinary conditions, a large amount of fluid or food in the gullet coincident with strong diaphragmatic and abdominal contraction that rupture could not take place unless there is present a weakened area in the viscus such as may exist in congenital deficiency, degeneration, or inflammation of the muscular wall or mucosa (Brosch). However, several instances of rupture have been reported in which, at autopsy, the viscus was apparently healthy. The condition occurs in men, generally drinkers, in middle life. The tear usually takes place in the lower third of the esophagus or at the cardia.

Symptoms.—The symptoms are those of a severe effort at vomiting suddenly followed by intense pains in the chest or epigastrium, a

choking sensation, dyspnea, cyanosis and collapse. Most of the cases are rapidly fatal, death following in a few hours, although when the tear is small in extent this may be delayed until emphysema of the mediastinal tissues and root of the neck takes place. In the retching that usually follows blood and mucus may be brought up, further suggesting the condition.

Treatment.—This may be designated as expectant, a large-sized dose of morphine and the use of quick stimulants hypodermically administered being about all that could offer any service. Of course no foods or drink should be allowed by mouth.

DILATATION OF THE ESOPHAGUS.

Ectasia of the esophagus is generally due to the presence of stenosis interfering with the easy progress of food and causing sacculation of the tube above the stricture. Such dilatations are usually fusiform in shape, the widest diameter being just above the obstruction, which latter is most often found in the lower third of the gullet or at the cardia. Many so-called idiopathic cases have been reported in which stenosis did not seem to be present, although even in these it is reasonable to understand that an esophageal or cardiospasm may have existed for local irritative or general neurological reasons, permitting bulging of the canal above it, and which by the usual methods of examination would not be revealed. It is also possible that such examinations are often made during the intervening period of the spasm, or give way most readily to the dilating instruments, or would be relaxed and not observable when seen at autopsy.

In the absence of cardiospasm and other stenoses, these dilatations are generally referred to as due to atonic degeneration of the wall. If it is reasonable to admit that in certain pathological conditions atony without stenosis permits of dilatation—and there is no doubt that this is true of the stomach and intestines—then it is also reasonable in the esophagus to refer such cases to an unobserved still actual preceding chronic inflammation, ulceration, or to a muscular condition from malnutrition, which atrophy is great enough so as to allow stretching of the weakened fibers until they are unable to recover themselves. Such a dilatation then could ensue without a preceding stenosis, is usually fusiform in shape, and most often found in the lower third of the esophagus. Most of the so-called idiopathic cases, however, have been described upon the most speculative etiology, of which the most interesting supposition is that of Fleiner, Strauss, and others, that these are explained by a congenital defect in the enter-

omeres, and that this is combined with a cardiospasm of neurogenic origin. More interesting in these cases is the fact that at autopsy such dilatations are usually fusiform in shape, and that when, during life, they had been examined by X-ray, it appeared as if a stenosis existed, but which actually was not so. In my opinion, Beneke's view on this is most logical—which is, that the traction and bulging of the lower part of the sac when it contains food pulls together the walls of the upper part of the undilated tube below, thus causing a kind of valve-like action at that point which further prevents the egress of the sac contents. And it is most probably due to this, that the majority of these cases, in the subjective way, clinically present themselves as those of esophageal stenosis, and in which the more or less constant distress is due to small retained particles of food decomposing in the gullet and thereby causing irritation.

Symptoms.—These are generally masked in those of stricture, remembering always that a strictured condition of the gullet could exist without a dilatation above it. The characteristic symptom is the regurgitation of rather large amounts of retained food more or less late after ingestion. While this food is in the dilated portion of the gullet there is usually a sense of oppression and weight and sometimes even actual pain in the sternal or epigastric region. At this time a degree of dyspnea is present with general restlessness and perhaps an increased flow of saliva. These symptoms generally abate when regurgitation has taken place and the gullet is emptied. If this is rather long delayed the food becomes decomposed and the breath is foul. The food when returned early is about as it was swallowed, and when tested for the stomach secretions (HCl, pepsin) these will be found to be absent. When secondary inflammation has taken place in the sac more or less constant sternal distress is present. In stricture the passage of instruments will be obstructed, but in the so-called idiopathic cases this is not so. The X-ray bismuth method of diagnosis may be most helpful in the diagnosis, although, as was mentioned before, could not serve to differentiate the true strictured from the non-strictured conditions. If the characteristic fusiform shadow is observed the use of the bougie is the only way of distinguishing between the two types of dilatations. In the presence of constant sternal distress an esophagitis may be suspected. In these instances ulceration and perforation are liable to occur, giving symptoms of those conditions. In all cases more or less inanition with the constitutional symptoms are present.

Treatment.—In cases due to stricture the treatment of this dominates that of the secondary dilatation. When operation has

not been performed, to combat the effects of the decomposition of food some benefit can be derived from lavage of the gullet. For this purpose a recurrent tube should be used so that a large amount of retained water is not permitted to further distend the sac and also to obviate the filling of the gullet and flooding the mouth. A tube should be employed which has the apertures of the inlet and outlet tube on a level near or at the tip. Plain water, normal saline, or boracic acid solution serve a good purpose, and when inflammation has taken place a 5 to 1000 silver nitrate solution is more beneficial.

In the idiopathic cases lavage should not be employed. About one-third of these cases are cured by the use of one of the various instruments for dilating the cardia. The instrument should be passed just into the cardia, the stretching performed in various directions, the treatment lasting for about 5 minutes at each séance. After 6 or more such stretchings the benefit usually becomes permanent, and the regurgitation stops, after which the patient usually makes most perfect recovery. In other cases the sounds or bougies answer. Electricity, mainly faradism, administered by means of an esophageal electrode with the positive pole in the gullet, answers a good purpose; the negative pole should be placed over the sternum, then the dorsal vertebra, then sat upon (gluteal region), and lastly, on the neck. In one of my cases in a young woman I feel that beneficial results came from the use of the following:—

℞ Strychninæ sulphatis	0.07	gr. j
Sodii bromidi	15.0	ʒiv
Elixir adjuvans	100.0	℥iiiss

Fiat et Sig.: Take one teasponful in a small amount of water three times a day.

NEUROSES OF THE ESOPHAGUS.

There is no doubt that neurotic conditions occur in the esophagus, although less frequently than in the stomach. It is usually quite impossible in a given case to conclude definitely whether the disturbance in the tube is an accompaniment to some local stimulating condition in its course calling forth the origin of the condition, or whether it is secondary to disturbances situated elsewhere in the digestive canal or neurological system. There is, however, in the majority of the acute cases a definite gastric condition combined with a neurasthenia or hysteria to account for them. In a continued severe case the most logical practice would be to explore the gullet carefully (possibly even with an esophascope), and take all matters pertaining to the general body into careful consideration with the hope of finding and removing an original cause if possible. For it is

manifest that when, for instance, some local condition in the esophagus (inflammation, ulceration) or in the stomach (acute gastritis, neurosis) is present, the successful treatment for the functional esophageal condition depends principally on the care of the parent condition. The gullet not having a specific secreting function in so far as the digestive secretions are concerned, the neurotic disturbances of the gullet have been classed as the sensory and the motor.

SENSORY NEUROSES.

Hyperesthetic or paresthetic conditions of the esophagus are generally symptomatic of affections situated elsewhere. Anesthesia is said to occur after such infections as diphtheria, but I fail to understand, with swallowing naturally a sensationless function, how such a condition could be accurately diagnosed or even that it could exist. What has been termed as hyperesthesia of the esophagus is the sensation of sternal distress that so commonly accompanies neurasthenic, irritative and high secretory states of the stomach, and the condition of disease in the tube itself. In these such symptoms as a slight pain in swallowing, a tightening or weighty feeling in the chest and a burning in the lower sternal region may be noted. The sensation of a lump, ascending or descending, constitutes the well-known symptom of globus hystericus which is so characteristic of hysteria. The burning sensation (pyrosis) noted in states of high secretion, particularly when neurasthenic conditions also exist, is the most often met with; in the production of this no doubt an insufficient cardia, permitting of regurgitation of irritating food, fluid or gases from the stomach, has much to do with its causation. Pricking and sensations of roughness (paresthesia) are less commonly encountered and, in my opinion, are due to stomach or general neurological conditions. The diagnosis of a sensory neurosis of the esophagus as a primary condition should be made with reluctance, for usually in the presence of this condition diligent search will disclose the existence of organic, functional, or neurotic disorder in the stomach or intestine, or some disorder in the neurological or circulatory systems accounting for its existence.

Treatment.—This then requires that the cause be recognized and the disorder improved or removed by appropriate treatment directed to the condition that exists. Very often, however, the esophageal symptoms of distress are such a prominent feature that measures of relief are necessary to be instituted for a short time. In accomplishing this the bromides and the valerian preparations answer to the best purpose. My experience has been that when marked esophageal dis-

tress exists larger sized doses than is ordinarily given are required to make the patient comfortable, and thus 1 to 3 grammes of the bromide and 4 cubic centimeter doses of the tincture or ammoniated tincture of valerian may be called for. A prescription I can recommend is the following:—

℞ Sodii bromidi ..... 20.0 ʒv
Tincturæ valerianatis ammoniata ..... 25.0 fʒvj
Aquæ chloroformi .....q. s. 100.0 f℥iiiss
Fiat et Sig.: Take two teaspoonfuls in water at meals.

Because of the liability of the contraction of the habit, the opiates and narcotic drugs should not be employed and attempts should be made to control the symptoms by the use of the safer medicaments in larger quantities. Neurasthenic states should be treated by higher feeding, hygienic, hydropathic and electrical measures, and by the employment of strychnine and the general tonics. The hematinic tonics are often indicated, and alkalies and atropine serve a good purpose in conditions of excess gastric juice secretion.

MOTOR NEUROSES.

As an entity these are more important than the sensory neuroses, and excepting the few cases of merycism or rumination are confined to spasms in various parts of the canal. As a rule, they are more or less severe in degree and persistency over lengths of time in the clinical history. The spasm may be excited directly by local disease in the tube, or, as most of them are, by functional disturbance in the neurological system, particularly in those who may be generally classed as neurotic individuals. This latter combination is most often found in those who are rather continuously hysterical, excitable or restless in temperament. In other instances, again, the condition appears as a reflex from gastric disturbance, particularly in those of hypermotility, the acute irritative, and the neurotic sensory gastric conditions. Pregnancy may be mentioned as a reflex cause. As was mentioned before, the spasm may occur in any part of the tube, it may be most general along all of its course, or rather local especially when confined to the lower part of the esophagus in the region of the cardia. The spasm may be migratory, traveling to different locations in a short time, is usually constant in its duration, and the stenosis is never observable at autopsy.

Symptoms.—As a rule, the onset of the condition is sudden and not following any local cause for stenosis. In this it differs from all of the other esophageal conditions and this point is most valuable in the diagnosis of the condition. All degrees of stenoses are encoun-

tered, sometimes slight and manifested only when certain foods are taken, at other times severe with complete dysphagia and regurgitation of material eaten some time before. In one who can swallow solid foods and not liquid the condition should always be suspected; in these latter cases considerable pain in the retrosternal region may be complained of. Dyspnea, oppression, palpitation of the heart, anxiety, syncope, and even convulsions may accompany an acute attack. The patients are generally excessively agitated or exhausted during a seizure which may last for only a few moments or even several hours. Instances are observed in which this variable history of acute attacks with intervals of entire relief have lasted over 10 or 20 years. In these neurological cases recurrence is particularly liable, and a long history of care in hospitals and under a number of different physicians is commonly obtained.

The cases I have seen have come under medical observation during the attack of spasm and the patients have given the history of some indiscretion in diet as the assigning cause. An interesting symptom in most of these was a rhythmical contraction of the faucial muscles producing a clicking sound in the throat. There is often the history of more or less loss of weight, and evidences of malnutrition and loss of nervous control are apparent. A trembling of the limbs is noted, with alternate seizures of weeping and smiling in a meaningless way. A rapid pulse is generally noted, the thyroid cartilages are prominent from contraction of the pharyngeal and laryngeal muscles, and the neck muscles stand out prominently and are firm to the feel. The reflexes are exaggerated. If efforts of retching and vomiting are present these are generally severe and persistent and the contraction of abdominal muscles most marked.

The diagnosis is usually made on the acute onset of the attack, the variability of the symptoms, the age, sex, and character of the patient, and the use of one of the esophageal instruments. In the passing of the bougie, sound, or stomach tube, the instrument is firmly grasped at the stricture area only to give way to complete patency of the canal in a few moments. On the other hand, even in the acute attacks the instrument will pass without difficulty into the stomach, although usually more or less hesitancy is met with in the region of the cardia. A stenosis which quickly disappears after the short use of the dilating instruments, the emptying of the stomach, the use of antispasmodics, or galvanism is positively spastic in character.

Treatment.—The best treatment during an acute attack is the emptying of the stomach. For this purpose the employment of the stomach tube is not so efficacious as the use of emetics. The reason

of this is because such attacks usually come on after a meal, and return through the tube is impracticable on account of occlusion of the tube with solid food. Apomorphine hydrochloride (5 milligrammes or 1/12 grain) hypodermically administered produces prompt evacuation of the stomach, and is safer to administer than the irritating and less dependable emetics by mouth. This should be followed by enforced rest in bed, abstinence from foods for a day, and the rather generous use of bromides. The following suppositories may be used during the 24 hours to relieve the nervousness but not longer:—

℞ Pulv. opii,
Belladonnæ foliæ,
Ol. theobromatis .....āā 0.4 gr. iv
Fiat et M. rectal suppositories no. vj.
Sig.: Insert one high into the rectum every three or four hours.

It is obvious that, as in other neuroses, the main indication is to increase the tone of the general health and the nervous system so that attacks or spasms will not recur. For this purpose strychnine sulphate (2 milligrammes, 1/30 grain) is of value and best given with valerian and the hematinic tonics. In the beginning of the treatment the addition of the bromides is often essential to minimize the danger of return, and belladonna or atropine may be employed as an antispasmodic. The use of the following is recommended:—

℞ Bromoformi ..... 1.5 gr. xxij
Tinct. belladonnæ ..... 3.0 ♏xlv
Elixir sodii bromidi ..... 100.0 ℥iiiss
Fiat et Sig.: Take a teaspoonful in water before meals.

Followed by and used singly later on:—

℞ Strychninæ sulphatis ..... 0.07 gr. j
Zinci valerianatis ..... 2.0 ʒss
Fiat cap. or pil. no. xxv. Sig.: Take one after meals.

Directions should be given that the stomach is never overloaded with food, and that the irritating articles of food as well as the use of tea, coffee, alcohol and tobacco be discontinued. The morning cold sponge, retiring early, and other general hygienic measures should be advised, and in the end a sojourn in the country. When the case is severe or persistent, a gastric analysis should be made, the feces examined for parasites, and perhaps the esophagus examined directly. Errors of refraction should be corrected, diseased tonsils removed, and abnormal conditions in the ears corrected if possible. An esophageal sound should be passed occasionally, and should obstruction be met with, firm, gentle pressure usually overcomes it, after which the instrument must be left in for some minutes. When cardiospasm exists,

with or without dilatation of the esophagus, the regular employment of a dilating instrument often gives signal results. Successful results from suggestive treatment during hypnosis have been reported. In very severe cases the keeping up of the patient's nutrition is of prime importance. In such instances rectal feedings may be indicated, and even the performance of a gastrostomy for temporary use is at times justified.

CHAPTER XVIII.

Organic Diseases of the Stomach.

ACUTE GASTRITIS.

SEPARATING the inflammatory diseases of the stomach of the catarrhal type into those which pathologically involve mostly the glandulature and are of short clinical duration, and those which involve also the submucosa, musculature, and connective tissue and are of longer duration, an arbitrary division into the acute and chronic forms is possible. While a division such as this is necessary to present the subject of inflammatory disease of the stomach, it must be said that sharp dividing lines between all of the types of these affections, both pathologically and clinically, must be but very elastic. Even those types of involvement which are confined strictly to the epithelium and glandular parenchyma must be divided into the acute and chronic forms. The separation is further complicated by the fact that basically, in both the acute and chronic forms, a further division is necessary into the primary and secondary types of catarrhal disease. The close examination of the stomach walls in a case which may have presented itself as an acute condition will often show evidences of long standing disorder of a chronic nature. On the other hand, the stomach case which manifestly had run a chronic clinical course and which shows marked histological changes in the permanent way, may also show much which is on the order of an acute condition. More or less degree of chronic gastritis is such a common and widespread condition, that most stomachs when examined in section display not only the combination of the acute and chronic pictures but even various parts of the same stomach will show marked differences in the elemental make-up. Approaching the subject of division from a pathological standpoint, uniformity of classification is almost impossible, although it would be the most desirable in the presenting of them. But approaching from the etiological and clinical standpoints, one can come nearer to some regular order.

ACUTE CATARRHAL GASTRITIS.

(Simple Gastritis, Acute Indigestion.)

Etiology.—Among the predisposing causes of acute catarrhal gastritis may be mentioned the acute fevers and infectious diseases; disturbed states of the general system, such as gout and other metabolic disorders; low states of nutrition, such as debility, anemia and the blood dyscrasias; and states of chronic congestions of the stomach due to heart, liver, and kidney disease. The exciting cause is usually some dietetic error, consisting of overfeeding, eating when physically too tired to digest foods properly, or when mentally depressed with grief, sorrow, terror or anger; the taking of foods unsuitable for the individual, those which are unripe or improperly cooked, or tainted foods, such as ptomaine-bearing ice cream, fish and meats; overindulgence in alcoholic drinks, or a simple drink taken in large quantities and which is too hot or too cold; and the taking of irritating medicine, such as quinine, metallic salts, acids and alkalies, iodides, and salicylates. Trauma of the upper abdomen may precipitate an acute gastritis in rare instances.

The condition is more frequently met with in men, no doubt because dietetic error and overindulgence in alcohol are more common in that sex. It occurs in all ages from the infant to the very old, in the latter of whom it might be a fatal condition. Most of the cases are seen in the summer and fall, due probably to the eating of unripe or overripe fruit, the excessive drinking of ice water and alcoholic fluids, or the eating of food substances which had become tainted during the hot weather. Those seen in the colder weather are usually due to overindulgence at the table in food or drink, or both together.

Pathology.—The mucous membrane of the stomach is swollen and presents a flat appearance. Congestion is usually present generally, although it may be seen in localized areas presenting a coarse mottling. Usually there is more or less tenacious mucus clinging firmly to the face of the glandulature. Spots of submucous hemorrhage may be observed, and small-sized superficial erosions are not uncommon in the pyloric region, which is usually the most affected in the process. The inflammation may extend into the duodenum, and in children may involve the entire length of the small intestine. Large suggillations may occur, but are rare.

The histological changes in the mucosa are usually marked, sometimes out of all proportion to the intensity of the symptoms. The gastric cells are swollen, and the interglandular substance may be

PLATE XXIX.

Severe acute gastritis. The flat appearance of the glandulature is due to swelling caused by hyperemia, infiltration of the mucosa with round cells and polynuclear leucocytes, general cloudy swelling of the glandular cells and superficial epithelium, and the exudate in the submucosa. At numerous places over the surface of the organ are seen adherent masses of tough, cloudy-white mucus. The tunica propria of the entire stomach was involved, but below the submucosa the structures were not included in the inflammatory process. No pus or bacteria could be found.

ed with polynuclear leucocytes. Portions of the columnar elium may be absent. Many of the acid cells do not show nuclei, ying merely a loose granular protoplasm. This same change is it in the central cells, but, because of their poor staining power, nore difficult to discern this. The upper portions of the gland es may be missing, suggestive of small-sized erosions. Bacteria ommonly found, the more frequent types of which are the bacillus aërogenes, bacillus coli communis, proteus vulgaris, oïdium

Fig. 83.—Section through the glandular layer of the stomach from a se of acute gastritis showing extensive round-cell infiltration in the erglandular structure. The dark clumps represent hemorrhage. × 105.

ns and streptococci. Because gastric digestion is inhibited in disorders and hydrochloric acid secretion absent, food particles ommonly met with adherent to the stomach surface. Beaumont hown that the surface of the membrane during the attacks is ly alkaline, or but very faintly acid.

ymptoms.—The clinical aspect of these cases ranges all the way the milder degrees of the simple dietetic forms in which the toms are mostly gastric, to those of the severe prostrating types o ptomaine poisoning in which the symptoms are general as is local in the stomach.

'he onset is usually acute, following a manifest indiscretion in

diet. There is first experienced a sensation of heaviness or fullness in the epigastrium, accompanied with a desire to belch. After ejection of some of the stomach gases, a short spell of relief is obtained, which may be followed by still greater gastric distress than before. Distinct nausea may be present, and, in those easily disposed to vomit, the stomach contents may be ejected, after which the relief of symptoms is marked. In the milder cases, the gastric distress may run along for an hour or two and then, without vomiting, it gradually subsides.

In the severe forms, nausea and acute gastric distress are early

Fig. 84.—Section through the stomach from a severe case of acute gastritis with exudate. The dark clumps represent hemorrhage. × 70.

symptoms. Eructations are rather frequent, affording only slight relief, and acute pains may be present in the stomach radiating to the hypochondriac and sternal regions. There may be present severe headache, a moderate rise in temperature, anorexia, the regurgitation of small quantities of sour or bitter-tasting stomach contents, marked thirst, palpitation of the heart, giddiness, rather continuous vomiting, and general nervous disturbance such as restlessness and a feeling of fear with profuse sweating.

The vomited matter consists of undigested food mixed with mucus and bile, and is of an acid reaction due to the presence of organic acids. If the vomiting continues when the stomach is empty

of food, the fluid contains saliva, mucus, bile, and even blood when the retching is severe. The ejected foods are usually seen in rather large-sized pieces designating absence of digestion even after they had been retained for some hours. Together with the lactic and butyric acids found, acetic acid in those who have drunk alcohol may be present in easily recognized quantities. Hydrochloric acid is generally absent.

The abdomen appears bloated and the stomach markedly tympanitic and sensitive to pressure. The bowels are usually constipated, although diarrhea may follow the attack. The tongue is coated, and the taste pappy. Herpes, urticaria, or erythema may appear especially when tainted fish and shellfish have caused the attack. As a rule the urine is diminished in quantity and quite high colored, particularly in the febrile cases. An excess of indican is the rule when vomiting has not occurred and the bowels remain constipated. The temperature, present in about half of the cases, may run as high as 105° F. (40° C.), and may be preceded or accompanied with a chill or chilly sensations. The catarrhal inflammation may invade the duodenum, and when obstructing the gall-duct, give rise to icterus.

In the forms which ensue from the taking of poisoned foods—meat, fish, ice cream containing tyrotoxicon—the symptoms are those of a severe gastritis. The vomiting is incessant, and the prostration marked. Cases frequently occur in a number of individuals of a family at the same time, or in small-sized epidemics among those who have eaten of some particular food. In severe cases, the prostration symptoms of small rapid pulse, feeble heart's action, cold clammy skin, blanched countenance, and look of apathetic resignation may be pronounced.

The commonly met with attack usually runs from one to four days. Neglected cases or those occurring frequently in the same individual may, by gradual transition, develop into the subacute or chronic form. In the ptomaine-poison cases, where the prostration is marked, the patient is apt to die. The same may be said of acute gastritis which occurs in middle-aged and old persons late in the course of long-standing disease. A few cases in children also terminate fatally.

Diagnosis.—When cause is apparent and acute gastric distress and fever are present, the diagnosis is easily made. The analysis of the vomitus showing absence or marked diminution of hydrochloric acid, the presence of organic acids, and the undigested character of the food are most significant. The slowly developing febrile forms in which the gastric symptoms are not marked may be confounded for a short time with beginning typhoid fever; the quick course of the one

and the absence of the symptoms of enteric fever will usually clear the diagnosis. While the Widal test would be absent in acute gastritis, the diazo-reaction of Ehrlich may be present, and thus much reliance in the differential way should not be placed on its presence. It should be remembered that many of the infectious diseases begin with a history of acute gastritis. Thus it is that in all cases with high fever, when cause is not plainly apparent, we should be guarded until time for pathognomonic symptoms of other diseases had passed. The temperature in acute gastritis rises sharply and then falls uninterruptedly to a normal level. The presence of herpes labialis would speak in favor of acute gastritis, but it may also be present in malaria and acute pneumonia. Acute exacerbations of chronic disease of the gall-bladder and ducts and biliary calculi not causing much pain or any icterus may be mistaken for acute gastritis. The differentiation between these conditions is simple.

Treatment.—This may be divided into medical and prophylactic, the latter having to do with not partaking of those foods and drinks which would cause the condition.

Medical.—The stomach emptying itself by vomiting, or by diarrhea if the stomach contents have passed into the intestines, and the persistent anorexia show how admirably nature cares for these conditions. Along these same lines with treatment of any special symptoms, such as excessive pain, incessant vomiting, or marked prostration, the therapy should be laid. If spontaneous vomiting does not occur and the stomach is distended with gas and food, measures should be instituted for the emptying of it. This is important when the gastric distress continues marked, or in the ptomaine-poisoning cases. Lavage of the stomach is the best means of accomplishing this. A hypodermic of apomorphine (grain $\frac{1}{20}$) may be given to promote vomiting in the sthenic cases, as it is always best not to give the strong emetics by mouth. In mild cases the drinking of one or two glassfuls of hot water may relieve the stomach distress, either by promoting vomiting or serving as an internal lavage in washing the stomach contents into the intestines. A little table salt or small amount of English mustard added to the water should be the only emetic measure employed per os. However, both Ewald and Boas recommended the following if emesis does not occur at the onset:—

℞ Pulveris ipecacuanhæ ..... 1.5 gr. xxiij
Antimonii et potassii tartras..... 0.05 gr. ⅚

Fiat chart. no. j. Sig.: To be taken at once or in divided doses.

In children the syrup of ipecac may be employed in a teaspoonful dose. A better method, in my experience, is to use smaller doses of the syrup (say 20 drops) giving it every ten minutes until vomiting occurs.

After the emptying of the stomach foods should be withheld for some time.

Later on, fluids like strained barley, rice or albumin water, or weak tea may be employed. Solid foods should not be allowed until the demand for them is rather insistent. On about the third day, thin soups, soft-boiled eggs, toast, bread and butter, oysters, and so on may be employed and, if these have been well borne, on the next day meats may be permitted, after which the resumption of the regular bill of fare would be safe.

When the local distress is marked, a mustard plaster on the epigastrium, followed by an icebag, are measures of service. Hot turpentine fomentations to the abdomen are helpful when there is much general distention in the intestines such as is sometimes seen during the subacute stage. In all cases, it is wise to employ a purgative after the stomach has become tolerant. For this purpose calomel is best, because, in addition to its purgative action, it is the best intestinal antiseptic we have, and in some cases has quite a sedative action on the stomach. Because of these it has marked advantages over oleum ricini, which may even aggravate the stomach condition and re-establish the acute symptoms if given in the first forty-eight hours following the onset of the attack. The advice of Ewald in employing calomel in two large doses of 6 grains each, giving them one hour apart, is excellent and much to be preferred to the giving of small subdivided quantities. Citrate of magnesia and Seidlitz powder are too gaseous and bulky, and stronger salines are ungrateful to these tender stomachs. It is well to withhold all laxative measures until about thirty-six hours after the beginning of the attack.

In the treatment of special symptoms it may be said that internal antipyretics should not be employed. The pyrexia is of short duration, its presence is valuable to denote the course of the condition, and usually not high enough to deserve special attention. Furthermore, the less put into these stomachs the better, and should prostration suddenly occur one would not be pleased at having coal-tar products in the circulation at the same time. For the pain and general distress a small dose of morphine or, better yet, codeine administered hypodermically is helpful, but counter-irritation and hydropathic measures should first be tried before resorting to them. The following suppositories are useful:—

℞ Codeine phosphate ..... 0.30 gr. v
Ext. belladonna ..... 0.03 gr. ss
Enough cocoa butter to make ten suppositories.
Sig.: One every hour until relieved, after which they are to be discontinued.

If vomiting continues after the stomach has been emptied, the mechanical sedatives, bismuth salts or cerium oxalate, are of benefit. A prescription of value in this connection is the following:—

℞ Bismuthi subnitratis ..... 6.0 ʒiss
Cerii oxalatis ..... 2.0 ʒss
Peppermint sugar ..... 3.0 ʒj
Fiat chart. no. x.
Sig.: Take one powder every hour until vomiting is controlled.

Sometimes a small quantity of brandy or cracked ice (eating the ice) or a mustard plaster to the gastric region will control the vomiting sufficiently well. When the symptoms of hyperacidity are present, pyrosis with thirst, the alkalies are of benefit. Lime-water on ice may be employed or the following:—

℞ Calcined magnesia,
Sodium bicarbonate,
Bismuth subcarbonate,
Peppermint sugar .....āā 8.0 ʒij
Fiat pulv. Sig.: Take one-half teaspoonful in water every three hours.

When the prostration is marked sustaining measures should be employed. In cases of ptomaine poisoning resort to strychnia hypodermically may be necessary early. Of course, these stomachs should first be cleansed by lavage so that further absorption of toxins is stopped. Unfortunately if the case is seen somewhat late, the tainted food may have passed into the intestine, and as this could not be extracted, measures of quick purgation, such as oleum tiglii or colonic enemata, may be wise after the lavage. The ptomaine cases not infrequently go into extreme collapse and require heroic treatment, such as would be employed in shock, to save them. Among these may be mentioned hypodermic injections of the stimulants strychnia, nitroglycerin, ether, whiskey, or the hypodermic preparations of digitalis. These may be used one quickly following the other without danger of overstimulation, for it must be remembered that in a serious case the prostration is progressive and liable to be quick.

Following an attack of acute gastritis, anorexia, aversion to foods, and some physical weakness may persist. In those cases the following tonic will prove useful:—

℞ Strychninæ sulphatis ..... 0.05 gr. ⅙
Acidi hydrochlorici dilut. ..... 30.0 ℥j
Elixir gentianæ .....q. s. 120.0 ℥iv
Fiat mist. Sig.: Take one teaspoonful in one-half glass of water before meals, through a glass tube.

ACUTE SUPPURATIVE GASTRITIS.

(Phlegmonous Gastritis, Gastric Abscess.)

Acute suppurative gastritis may occur as a primary idiopathic malady or as a complication of other gastric affections. Among the

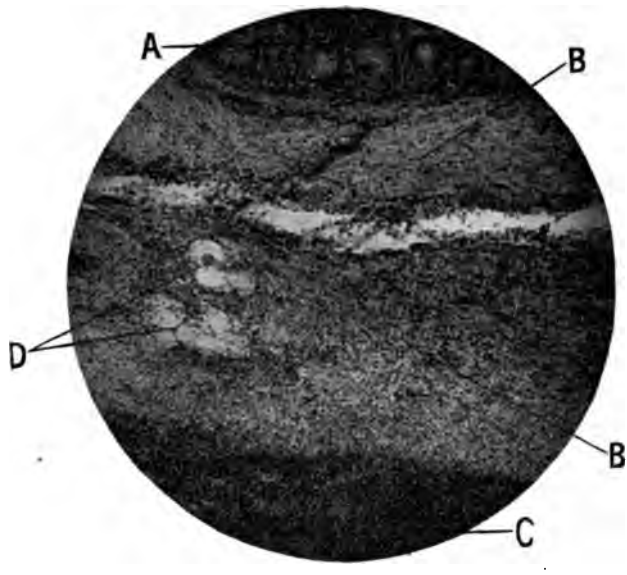


Fig. 85.—Photomicrograph of a section of the stomach from a case of phlegmonous gastritis. *A*, Gastric mucosa densely infiltrated with pus cells in the interglandular connective tissue. *B*, Submucosa very much thickened and infiltrated. *C*, Purulent collection which oozed out when the cut was made through the stomach wall. *D*, Fat tissue. × 200.

latter may be mentioned the forms which occur in stomach cancer or in the infectious diseases typhoid, puerperal fever, pyemia, variola, anthrax, severe exanthemata, and articular rheumatism. The disease is a rare affection, occurring either in the diffuse infiltrative or rather localized form of gastric abscess. Up to the present time, since Borel first mentioned it in 1656, about one hundred cases have been reported. The disease is more common in men than in women, and is generally fatal. It is caused by the entrance into the submucosa of a virulent organism, usually the streptococcus, through some defect in the gastric

mucosa, although at autopsy this defect is rarely seen. While the streptococcus pyogenes is the most often found, other organisms, such as the staphylococcus, the bacillus coli communis, and the pneumococcus, may be present. Where focal abscesses occur, mixed infection may be observed. It is usually met with in laborers of late middle life of the alcoholic type.

Pathology.—The suppurative process may be rather general throughout the stomach, or be present in circumscribed abscesses in the gastric wall. In the diffuse inflammation the pyloric region is mostly involved, presenting itself as swollen, boggy and pale yellow in color. The esophagus is rarely attacked. On section of the pyloric submucosa, a yellow glaring layer from 1 to 5 millimeters thick, which on pressure exudes puriform material, is the common picture. In the diffuse forms, small shallow ulcerations down to the submucosa are often found along the lesser curvature and throughout the stomach. When these ulcers are very small (1 centimeter in diameter) they may display a granular floor with a reddened periphery. While the orifices of the tubules are usually clear, the papillæ of the duodenum may be prominent from increased stroma and polynuclear infiltration.

On microscopical examination the stomach wall shows marked infiltration of the upper layers with pus cells, polynuclear leucocytes, serum, fibrin, micrococci, endothelial cells, lymphocytes and eosinophilic leucocytes. The deeper layers are infiltrated with lymphoid and plasma cells and eosinophilic leucocytes. The infiltration usually extends throughout the interglandular tissue causing small ulcerations on the surface through which the pus wells up from the submucosa. The muscularis shows a fatty degeneration, and the peritoneum may be raised from it by inflammatory exudate. These latter cases are the ones which are liable to perforate, although the same may occur through a circumscribed abscess, which in size extends from the miliary form to one as large as a hen's egg.

Other accompanying pathological findings in these cases are congested areas in the region of the stomach, a cloudy fluid collected in the peritoneal cavity, congestion of the pancreas, pus in the pleural and pericardial sacs, pneumonia, nephritis, and purulent meningitis.

Symptoms.—The onset is acute. The patient suddenly experiences an intense pain in the gastric region which is not increased by pressure or change of position. With this burning pain comes an extreme thirst, dry tongue, and an obstinate fever of 103° F. to 105° F. The case may be ushered in with a chill. The pulse becomes small, fast and then irregular in the early stage. The patient is extremely

restless and distressed, and these symptoms are soon followed by delirium. While retching is generally present, vomiting may or may not be. When it occurs, the vomiting consists mainly of mucus and bile, in which are pus-cells, numerous bacteria of the one type, and blood-cells. In the onset the bowels do not move, but shortly afterward a diarrhea occurs. Within a few hours prostration and coma ensue. Perforation into the general peritoneal cavity may occur, giving the abdominal symptoms of that condition, or the case runs a subacute course, continuing so for one or two weeks. Should abscess of any size occur, it might be felt externally. If a localized plastic peritonitis takes place, a friction rub may be heard behind the costal cartilages on the left side (Wagner).

Diagnosis.—The all-important symptoms are the finding of pus and large amounts of bacteria (particularly streptococci) in the vomitus. As vomiting is the rule in these as well as in all cases of severe acute gastritis, this detail of examination should be carried out. Should rupture of an abscess occur into the stomach it would be an easy matter to observe pus in the gastric contents or vomitus. Its absence, however, should not exclude phlegmonous gastritis, because cases have been reported in which the stomach ejecta did not contain pus. One would then have to depend upon presence of organisms and the symptoms of pain, vomiting, meteorism, fever, diarrhea, and general phenomena of serious illness. According to Ewald, the cases may so mimic abscess of the spleen or left lobe of the liver that a differential diagnosis is impossible. When localized swelling is observed, an exploratory incision or puncture with an aspirating needle may be justified; the first is decidedly the safer procedure. In cases in which the physical signs are vague or the fever absent (small number of cases), diagnosis cannot be made during life.

Treatment.—As these cases are almost invariably fatal, especially the diffuse form, the treatment is only symptomatic. Among measures to be used is the lavaging of the stomach with a 1 : 10,000 corrosive sublimate or a half-ounce of boric acid to a quart of water. Large doses of opium can be employed to control the pain and general distress, ice-cold applications to the abdomen may be used, and when collapse occurs, the hypodermic employment of strychnine, ether, camphor, and like stimulating measures. Medicines by mouth are of little value, but iced champagne or brandy may be used with some benefit. Should localized abscesses occur, drainage by surgery is in order. Recovery has been reported, but remembering that all acute gastric inflammations, even the simple acute gastritis, are more or less infectious conditions, and that the diagnosis of the phlegmonous form is

so rarely made and is such a fatal condition, mistakes in diagnosis may have occurred. Still, when only circumscribed abscesses are present, these, by rupturing through the mucosa into the cavity of the stomach, might drain sufficiently for spontaneous recovery to take place.

INFECTIOUS GASTRITIS.

What are designated as infectious gastritis are those conditions which are caused by the invasion of bacteria other than the strict suppurating type and those due to worms or fungi. Among causative factors which have been reported are the diphtheria and anthrax bacilli, the favus, thrush and yeast fungi, and animal parasites such as the larvæ of diptera (maggots). It is also known that ascarides and tapeworms may reach the stomach in rare cases and give rise to inflammation.

The symptoms are those of a rather severe and prolonged form of acute simple gastritis, lasting with fever for one or two weeks and may be mistaken for typhoid fever.

The treatment for them is chiefly expectant. With lavage and small doses of calomel they are generally favorably influenced toward recovery. Should there be reason to believe that intestinal worms are present in the stomach, measures for their removal should be instituted.

TOXIC GASTRITIS.

Etiology and Pathology.—This is an intense form of gastritis produced by the ingestion of corrosive and irritant poisons. Among those taken by mistake or with suicidal intention are: carbolic acid, potassium cyanide, corrosive sublimate, arsenic, antimony, chloroform, oxalic acid, the mineral acids—sulphuric, hydrochloric and nitric, and the caustic alkalies in strong solutions. Strong solutions of alcohol and ammonia and croton oil should also be mentioned in this connection. When caused by the non-corrosive poisons, intense hyperemia and tumefaction leading to desquamative changes in the glandularis ensue. The mucosa becomes swollen, superficially necrotic, and hemorrhagic in spots. The corrosive substances cause a more general necrosis of the mucous membrane, leading even to an involvement of all of the coats and rupture of the stomach into the peritoneal cavity. The non-corrosive group are less intense in the destruction of the parts they come in contact with, and are more commonly accompanied with fatty degeneration of the mucosa and small-celled infiltration of the entire glandulature connective tissue. The lesions may be of various

PLATE XXX.

Stomach from a case of toxic gastritis due to carbolic acid poisoning. The entire inside of the stomach showed the caustic effects of the poison. The glandulature was thickened and firm, and had an opaque milky appearance. There were small hemorrhagic spots here and there, and in places the submucosa had been bared of mucosa. The stem of the specimen is the esophagus.

grades of severity, and are either general or localized. In the corrosive poison cases the mucous membrane of the mouth, pharynx, and esophagus show necrotic areas.

Symptoms.—Shortly after taking the poison there is generally an intense agonizing pain with intolerable burning in the epigastric, sternal, and mouth regions. The stomach region becomes exquisitely tender, and pressure thereon causes marked distress. Vomiting soon ensues which becomes incessant, and this, by increasing the pain, may cause fainting. The vomitus contains mucus, blood and, sometimes in the corrosive poisons, shreds of mucosa. The thirst is great, and diarrhea of thin bloody passages is the rule when enough of the poison had been taken. Dysphagia is quite a common symptom. Severe general symptoms follow: small, very fast pulse, profound prostration, the skin cold and clammy, the respiration hurried, and delirium may be present. In cases where the poison reaches the general circulation, hematogenous jaundice, petechiæ, albuminuria and hematuria may follow. Sometimes there is a marked febrile movement, the temperature reaching to 104° F. (40° C.), and life may be spared long enough for a fatal toxic nephritis to develop. Death may follow in a few hours, or in a few days from collapse; or later from perforation peritonitis. Much depends upon the character and quantity of the toxic agent swallowed and the quickness of the employment of rightful measures of treatment. In the cases which recover from the acute poisoning stage, stenosis of the esophagus, cardia or pylorus may occur, or an atrophy of the mouth and stomach mucosa ensue with subsequent inanition.

Diagnosis.—This, providing unconsciousness has not set in, is usually made by cross-examination of the patient, or by the history obtained from those near by. Added to this are the stomach symptoms and the information obtained from the examination of the mouth, throat, or vomitus. A chemical examination of the stomach contents and urine may be necessary. In the case of carbolic acid the smell of the breath is usually suspicious, while when "Paris green" had been taken examinations of the mouth will display vivid green-colored particles about the teeth and in the throat.

Prognosis.—This should be considered as serious in every case. Much depends upon the kind of poison and quantity swallowed and if vomiting had occurred shortly afterward. In these latter cases where free emesis had occurred, the local and constitutional effects are mitigated. Among unfavorable symptoms are early collapse and those of peritonitis. Favorable prognosis should be withheld until the time for severe secondary effects has passed.

Treatment.—To ascertain first the poison taken and the use of an antidote for that substance are measures of prime importance. If the case is seen early, the stomach should be washed with warm water containing some demulcent substance and a small quantity of the antidote. Lavage, however, should not be resorted to when some time has elapsed after the ingestion of the poison, for if deep necrosis in the stomach exists there is danger of perforating the stomach. Syphonage of the stomach would then be preferable, and for this, even in extreme cases, it would be best to employ the tube and take chances. The employment of a soft stomach tube is safer and more satisfactory than the use of the Kussmaul pump.

Among the antidotes employed are: in the caustic alkalies, dilute vegetable acids, lemon and lime juice, or vinegar; in antimony, tannin in demulcent drinks; in arsenic, sesquioxide of iron, made by adding carbonate of sodium to tincture of the perchloride, or dialyzed iron may be used; in carbolic acid, alcohol, solution of sulphate of magnesia or of soda, dilute sulphuric acid, or saccharated solution of lime; in hydrocyanic acid, 2 drams of magnesia in water, followed by 15 minims of perchloride of iron and 12 grains of ferrous sulphate in aqueous solution; in iodine, starch water; in mercurial salts, white of egg and flour; in oxalic acid, lime or magnesia; in phosphorus, sulphate of magnesia. The use of olive oil or molten vaseline in the stomach, after neutralization and lavage, diminishes the effect of the corrosive poisons excepting in phosphorus poisoning.

Additional matters of treatment are the use of morphine to control the pain and general distress, bismuth and bits of ice to allay the irritation, and an ice bag externally in peritonitis. Nutrition should be maintained by rectal enemata only, and recourse to stomach feedings should not be permitted until recovery is well established. The other points of treatment are entirely symptomatic. Prostration and collapse should be combated by the usual measures of quick stimulation.

CHAPTER XIX.

Organic Diseases of the Stomach.

(Continued.)

CHRONIC GASTRITIS.

PRELIMINARY REMARKS.

WHAT is designated as chronic gastritis is a clinical entity due to pathological changes in the stomach, and not necessarily any gastric case which simply runs a chronic or subacute dyspeptic history. The term "catarrh of the stomach" is as unfortunate in this connection as is "catarrh" in any of the other parts of the human economy. The author fully coincides with Ewald and Penzoldt in objecting to this obselete term, which, like "malaria" and "congestions of the liver" of the past, covers a multitude of sins of ignorance and thus is doomed to oblivion in the years to come. For, to be literal, the definition of the term catarrh means a discharge of fluid from a mucous membrane, and this, like edema, deals with a symptom and not with the causative pathological condition. More than this, even in the light of symptomatic worth, severe as well as slight degrees of organic stomach change may exist without any increase in the amount of mucous flow beyond the normal quantity. Likewise, it must be said that the term "chronic dyspepsia" (sometimes used as a synonym for chronic gastritis) also should not be used. The reason of this is because chronic dyspepsia deals only with the length of the clinical course and not with the pathological diagnosis, which, it may be said, is as liable to be a simon-pure neurotic disturbance of secretion, motility, or sensation as a condition due to degeneration and desquamation of the glandular cells, infiltration of the connective tissue, or organic change in the musculature of the stomach.

A clinical and therapeutic distinction of service in severe cases of chronic gastritis is the division of the cases into one of two types—the sthenic and asthenic. The sthenic cases are those which have to do with increased secretion of hydrochloric acid and gastric enzymes, and sometimes motility; and the asthenic those in which these are diminished or absent altogether. In the pathological classification three main types of chronic gastritis may be separated, namely, the simple chronic gastritis in which the elements in the glandulature are mostly

affected; the hypertrophic or sclerosing form, where in addition to the above the connective tissue and musculature are proliferated; and the atrophic form showing loss of epithelium, actual destruction of the glands themselves and more or less new growth of connective tissue in some cases.

Added to these distinctions again are the primary and secondary types. The former being the cases which develop and are sustained by continued indulgence in foods unsuitable in quantity or quality, the overindulgence in alcoholic drinks, or the use of irritating alimentary substances, among which may be mentioned tobacco, abuse of purgatives, etc. The secondary forms are those which develop from attacks of acute gastritis plus continued indiscretion, and those which represent complications of other gastric or general affections.

Chronic gastritis is clinically a disease of degree of pathological change rather than one of definite type of morbid process. For while knowledge of definite states of morbid process at the time present much of practical value, it must never be forgotten that in these advancing conditions one state of pathological process is a transitory condition passing from the beginning one in the superficial structures to the end ones in which all of the layers of the stomach are more or less involved. Nor does the whole of any one or all of the layers of the stomach affected always display a uniform degree of change. Within one microscopic field the mucosa of what may be considered as a simple chronic gastritis may show distinct infiltrative change on the one hand, as well as perfectly normal tubules on the other, and in what may be considered as a distinctly hypertrophic condition may display normal, simply affected, or atrophically involved tubules and submucous or muscular involvements, and even in the atrophic conditions normal tubules may be seen alongside of tubule sheaths completely devoid of cells, while the interglandular and submucous tissues may display normal areas as well as some markedly infiltrated. It is for these reasons that it is proper to keep in mind a rather composite picture of the various pathological states, and view them all in the migratory sense of one as parent to the other, with simple chronic gastritis as the beginning and complete atrophic change as the end destructive condition. It is most probable that it will always remain impossible to diagnose in the living subject just what the detail picture of the stomach layers in a chronic gastritis is. Gastric analysis, states of motility, and subjective symptoms are all we now have to figure upon, and with these in our present state of knowledge, and unless we might accidentally gain particles of gastric mucosa for examination, much of diagnosis in the ordinary run of cases remains as a supposition, and thus

the most logical basis of treatment is fixed on rather symptomatic standards.

ETIOLOGY.

Chronic gastritis is a common and widespread disease, occurring in all stations and ages of life, and more frequently met with in men than in women. It is caused in the direct cases by continued dietetic errors and methods of eating, among which can be mentioned the eating of foods inferior in quality or irrational in preparation, fast eating resulting in imperfect mastication, overfeeding, excessive drinking of iced fluids, and the intemperate use of alcohol. The excessive use of tea, coffee, and tobacco are potent additional factors, and also the overindulgence in carbohydrates and fats. Among many cases it must be said that two or more causes are usually existent in the same case, and that all of the factors given above tend to irritate the stomach and therefore cause a change in the histology and function of the organ.

Fast and overeating, the continued taking of overseasoned foods, and the drinking of alcoholic or iced drinks are the most common causes in its production. Among those who habitually partake of the lighter forms of still wines at their meals, chronic gastritis is not so common as in those who partake of the spirituous ones (whisky or liquors), those which are carbonated (champagne, sparkling Moselle), or those which contain much carbohydrate (beer, ale). The etiology in moderate alcoholic fluid drinkers is often associated with dietetic error, and these cases are liable to be found in those who are well nourished and who lead a steady and regular life in other ways. Among direct conditions which may start a chronic gastritis may be mentioned an acute gastritis incompletely resolved, typhoid fever, and an unhealthy condition about the mouth, such as carious teeth.

Chronic gastritis is commonly present as a secondary disorder caused by the irritation of other gastric affections. Among these are cancer, ulcer, atony, and long-standing neurotic secretory and motor disturbances. It also accompanies the constitutional disorders of anemia, chlorosis, leukemia, chronic tuberculosis, Addison's and Bright's disease, gout, nephritis, diabetes, syphilis and amyloid. And, again, it may result from conditions of the portal circulation causing chronic engorgement of the digestive mucous membrane, such as is present in hepatic cirrhosis, chronic heart and some chronic lung affections. It may accompany or develop from almost any subacute or chronic disorder causing debility or devitalization of the general tissues of the body.

PATHOLOGY.

Simple Chronic Gastritis.—In simple chronic gastritis the organ is usually slightly enlarged, the mucous membrane pale gray, and in parts reddish in color and covered by a closely adherent tenacious mucus. At the pyloric end, the mucosa may be found irregularly pigmented and presenting a rough, mammillated surface; to this latter condition has been given the terms *état mammeloné* and gastritis polyposa. While the membrane is usually thicker than normal, it may be much thinner and firmer. The pyloric region is most affected, although a very general uniform process throughout the organ may be observed.

The minute anatomy shows a parenchymatous and interstitial inflammation of the glandularis, and in long-standing cases limited states of infiltration of the submucosa and perhaps some degree of hypertrophy or atrophy of the muscularis. The gland cells show cloudy granular swelling, and the distinction between the central and acid cells cannot be recognized, particularly in the glands of the pyloric region. Usually with tubules giving the above-mentioned picture are seen tubules containing cells in more or less advanced states of fatty degeneration, cells detached from the basement membrane and laying free in the space, or tubule sheaths entirely devoid of cells. The common picture of the cells is one of mucoid degeneration. It is this rather composite degenerating state of affairs of the glandularis that gives to the histology of all types of chronic gastritis their similarity. The difference plainly is only one of degree, although in what may be considered as the true simple chronic gastritis only the cells in the upper part of the tubules may be affected, while those near the fundus of the gland may be found quite normal. The tubuli themselves may have lost their normal regular arrangement and show atypical branching like the fingers of a glove. This spreading is due to round-cell infiltration, which is seen mostly in the superficial region of the glands. The gastric epithelium is frequently defective, and the mouths of the glands are filled with a pale mucus. The veins are usually enlarged, and small areas of hemorrhage may be observed in the pyloric region.

Hypertrophic and Sclerosing Gastritis.—These types represent more advanced conditions than the above. The membrane may either preserve a rather normal appearance or is most irregular from hypertrophic changes of the connective tissue about and below the glands, causing the mucosa to be thrown up in ridges. The histological state which causes the formation of these ridges is particularly connective-

tissue change about the ductus alveoli of the peptic glands. If these hyperplastic processes are confined to localized areas they cause irregularity on the surface of the membrane at that point, while an inch or two from it the membrane may have quite a normal appearance. When the submucosa is involved, as is generally the case, the loose tissue of this strata is rendered tougher and more inelastic, resulting in less freedom of movement of the glandularis upon the inner muscular coat. This fact, interfering as it does with the proper degree of circulation of blood to the glandularis during digestion, together with the destruction of the cellular elements in the tubuli above, which ranges from simple protoplasmic change to complete loss and vacuolization, explains the low or absent state of gastric juice secretion in the cases.

In the further advanced conditions, a sclerotic atrophy with thinning of all of the coats of the stomach (phthisis ventriculi or complete atrophic gastritis) may ensue, or an enormous thickening of the coats of the stomach may be found due to an hypertrophied muscularis from chronic inflammation transmitted down from the submucosa (cirrhosis ventriculi).

When this is present the general infiltration and contraction of the connective tissue and the hypertrophy of the muscular layers cause marked reduction in the size of the organ. There being more muscular tissue in the pyloric region, a stenosis of this area is often observed, and to which condition the term hyperplastic stenosis, in contradistinction to the stenosis of malignant disease, has been given. The hypertrophic muscular types of late gastritis are in my experience less common than the atrophic form, in which the organ remains normal in size or is somewhat dilated.

Atrophic Gastritis.—This form may be the termination of a simple chronic gastritis or it may begin as an atrophic form at the start. It represents the end pathology of the most severe types of chronic gastritis, one, it may be said, in which the stomach as an organ had lost its digestive function in the way of secretion (other than mucus), but usually retains the faculty of sensation and some degree of motility. It is probable that the typically thinned-out stomach of an atrophic gastritis begins as a glandular involvement from which early deep submucous and muscular change is not so much of a feature as those which pass to the hypertrophic stage from a simple chronic gastritis. I believe that the extent of inflammatory cell infiltration of the stomach layers has to do with why a progressing chronic gastritis in one case develops an hypertrophic state and why in another all of the coats become atrophic. It has appeared to me from careful microscopic examination of the stomach walls in three cases of atrophic gastritis

that the condition was due to a gastritis more definitely confined to the glandulature and in which there was a more complete degenerative change in the tubule cells as an early instance. The pathological picture in these stomachs is one of extensive change in the elements of the tubules, and, from lack of gastric function, an atrophy of the organ takes place such as invariably occurs in the soft parts of the human body from loss of specific function.

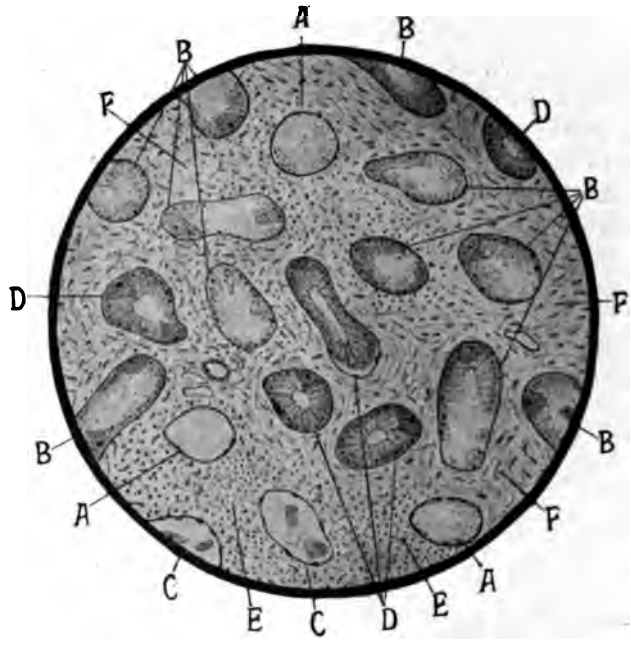


Fig. 86.—Mucosa in atrophic gastritis. Microscopic view of a post-mortem section from an alcoholic case of long standing. *A*, Round spaces of tubules denuded of cells. *B*, Gastric tubules containing cells with mucoid degeneration showing loss of cell-structure and staining power. *C*, Gastric tubules showing the intermediate stage between *A* and *B*. *D*, Apparently normal gastric tubules. *E*, Small round-cell infiltration. *F*, Increased interstitial tissue. × 400.

The surface of the mucosa is smooth and of a grayish color in complete cases. General pigmentation and congestion are not often seen, but areas of hypertrophic formations, hemorrhage, or small ulcerations may be observed; the latter are termed chronic catarrhal ulcers.

The study of the glandulature shows marked degeneration and destruction of the glandular elements. While in a case not completely advanced, tubules may be seen containing cells which stain

well and are in proper alignment, the majority of them are in a greater or lesser stage of degeneration. These are noted in the processes of mucoid and fatty degeneration, the detachment of the cells from the basement membrane, and finally their complete disappearance, leaving only empty spaces. In the advanced cases the infiltrative and con-

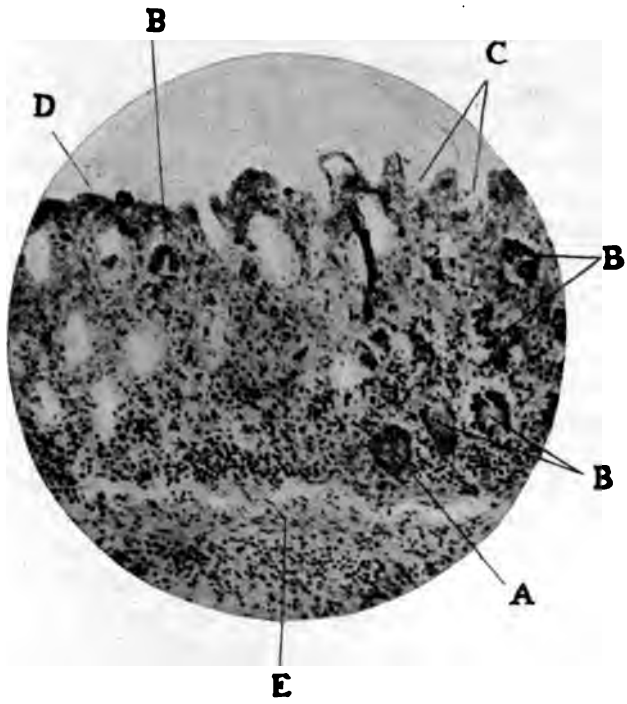


Fig. 87.—Photomicrograph of the glandular layer of the human stomach in a case of advanced atrophic gastritis. At *A* is shown a cross cut through a gastric tubule in which the normal cell picture is still preserved. The *B*s show tubules in various stages of degeneration. The clear spaces in the section represent tubules entirely denuded of cells, and along the free surface it can be noted that the columnar cells are also gone. The infundibular have broken down at *C*, and at *D* they are completely obliterated. The entire glandularis is infiltrated with round cells which are seen thickest in the lower region of the tubules and in the submucosa. Muscularis mucosæ at *E*. The specimen shows the loss of characteristic structure of the secreting portion of the stomach as the case showed clinically in its achylia gastrica. × 100.

tracted changes of the interglandular substance finally close up the tubules, causing their obliteration and leaving here and there irregular, cyst-like formations. An occasional tubule down near the submucosa may display glandular elements not entirely destroyed. But when such are seen, the area above them is in such indefinite arrangement

and there is so much infiltration around them that plainly such could serve to no purpose in the way of gastric-juice secretion. The columnar cells covering the surface of the mucosa and lining the alveoli of the glands are completely lost.

It should finally be mentioned that this same picture of mucous destruction may be seen in hypertrophic gastritis, and, as was stated at the onset, that different portions of the same stomach may show all of the above-described clinical types. It is to the extent that a certain progressive change predominates that the terms simple, hypertrophic or sclerotic, or atrophic chronic gastritis have been given to designate the type.

SYMPTOMS.

As a rule, the onset of a chronic gastritis cannot be determined. The disease usually develops very gradually and insidiously. The initial symptoms are not well marked and thus the condition is usually ignored. After a time, however, disturbances become pronounced and a series of many varied symptoms present themselves. Among these is a sensation of fullness and pressure in the gastric region coming on after meals, with a general feeling of oppression. Dizziness, palpitations of the heart and shortness of breath (asthma dyspepticum) may be present. These may be relieved by belching, although a rather steady distress in the stomach continues during the major part of stomach digestion. Sometimes the distress and pain continue when the organ is empty, and on pressure over the stomach an indefinite sense of mild degree of diffuse pain or distress is complained of. Among the most constant symptoms are the following:—

Mouth.—The tongue is coated and the patient complains of a bad taste in the mouth. The latter is most marked after meals or in the mornings, but may be present as a constant condition. Regarding the looks of the tongue, it may be red on the tip and margin with a triangular-shaped coating on the dorsum, or the entire tongue may be soft, pale and flabby looking, showing serrations from the teeth, and generally covered with a thin fur. The breath may be tinged with a fetid odor; particularly is this present when the teeth are in a carious state. Catarrhal states of the faucial and oral membranes are common. Among the conditions observed are pharyngitis, post-nasal catarrh, and stomatitis. When much catarrhal involvement is present in the mouth the breath is more offensive, and complaint is made that "foods have no taste." The secondary involvement of the mucosa of the throat is the origin of the so-called "stomach cough."

Stomach.—The appetite is fitful in the majority of cases—that is, at one time it is poor and at another much improved. More or less

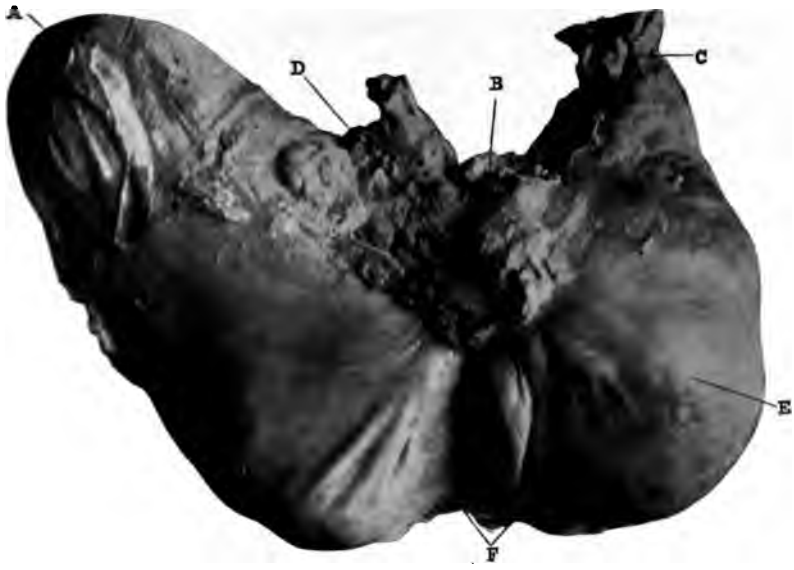
PLATE XXXI.

Gastric mucosa in a case of advanced hypertrophic gastritis due to chronic alcoholism. In places the membrane was hemorrhagic but it had mostly a dull slate gray color. The mucosa was much thickened and thrown into ridges. All of the coats were hypertrophied. The organ contained much fairly firm, thick, glassy adherent mucus, and sections through the organ showed all stages of degeneration of the glandular cells; increased fibrous tissue formation, mostly between the vestibular entrances to the gland ducts—the contraction of this fibrous tissue is the cause of the ridges—and of the musculature, mostly at the pylorus. The stomach as a whole was not contracted and there was no actual stenosis (hypertrophic) at the pylorus.

PLATE XXXII.

Hypertrophic gastritis. *A*, Pyloric region laid open showing the ıickened musculature and increased fibrous tissue. *B*, Cavity of the omach. The mucous membrane is thrown up into the rounded ridges seen ı a late hypertrophic gastritis. The tubules in the glandularis itself had een practically destroyed (atrophic gastritis). The entire organ was ɔntracted and stiff from connective tissue formation in all of the layers.

PLATE XXXIII.



Posterior view of the stomach of advanced gastric cirrhosis due to a sclerosing gastritis. In some parts of this specimen, at *E*, the stomach wall was 2 centimeters in thickness and was a firm fibrous consistency with marked hypertrophy of the musculature. The pyloric aperture was 0.5 centimeter in diameter and the distance between the center of the cardia and the pyloric opening was only 4 centimeters. Below the attachment of the gastrophrenic ligament, or lesser omentum, is seen a constriction running vertically through the organ, giving the appearance of a typical hour-glass contraction. The cavity of the stomach held only 265 cubic centimeters of water. *A*, Fundus. *B*, Cardia. *C*, Pylorus. *D*, Attachment of the gastrophrenic ligament. *E*, Thickest parts of the organ. *F*, Contraction partially dividing the lumen of the organ. (The reproduction is a trifle more than two-thirds the actual size of the organ.)

PLATE XXXIV.

Gastric mucosa from a case of atrophic gastritis due to chronic alcoholism. From the cardiac end, along the lesser curvature to the pylorus, and almost all of the left half of the specimen, shows a flat appearance to the mucosa. The lower right quarter shows evidences of a hyperplastic gastritis (marked rounded ridges). In the entire specimen the glandulature had been destroyed and replaced by fibrous tissue and small round cell infiltration. There were no secretions of hydrochloric acid or enzyme in this stomach during life.

anorexia is usually present in the running way. In some cases again, anorexia is not observed and the desire for foods may be quite normal. Freakiness in the selection of foods is common, and there may be present an absence of the desire for foods of the ordinary and best forms. Among the irregular foods sought are those which are piquant, salty, or acid. A common symptom in this connection is the satiety that comes from just a few mouthfuls of food or drink. Thirst, however, may be much increased, and there may be present increase in the salivary and pharyngeal secretions.

Nausea is an early and more or less present symptom, particularly in the severe states of gastritis. It usually comes on after the meal, but may be present when the stomach is empty. If vomiting of foods occurs, the nausea is relieved for the time being. A burning sensation may be present under the sternum (pyrosis) due to hyperacidity from increased hydrochloric or organic acids in the stomach. At these times there may be present eructations of a sour acid gas or fluid. Distinct flatulency is suggestive of gastric atony or that marked neurotic disturbance is also present. Vomiting of the entire stomach contents is rarely observed, but may occur because of some acute indiscretion in diet. It is more of a regurgitation of small quantities of stomach fluid, consisting of mucus with particles of food in various stages of digestion. When this is present it is most frequently met with in the mornings before or after breakfast. In alcoholic cases considerable retching and the bringing up of mucus, bile and saliva is a common and characteristic morning symptom. In atrophic gastritis complete vomiting may be a prominent feature. From the long passing of undigested foods into the intestines an enteritis may be present, or a functional disturbance of the liver. These, of course, would add intestinal symptoms to the case. In the well-advanced hypertrophic cases the clinical picture is one of pyloric stenosis and a diagnosis from pyloric carcinoma may be quite difficult. It may be said in the distinctions between these that in the gastritis cases gastric bleeding is rare, the condition is more of a chronic one, and should a mass be felt in the epigastrium (hypertrophic stenosis) it would always be small in size and remain sharply confined to the stomach proper. There would also be absence of collective vomiting, since these stomachs are always contracted and unable to hold more than a small amount of nourishment at any one time.

General Nutrition.—In early cases the appearance of the patients is quite good. They look well nourished and one would hardly suspect that a state of chronic gastritis existed, even as I have seen in a few rather advanced cases. In the course of time, if attention had not been given to the condition, inevitable change in the general nutri-

tion and state of health ensues. This, as von Noorden has suggested, is partly due to "most dyspeptics not eating enough." While this is true in the main, cognizance should be taken that, because of the degenerative change in the stomach and the enteritis which may ensue from the disturbance in gastric secretion, the general health may suffer even when sufficient food is taken. In the atrophic cases there is present a progressive anemia, resembling a moderate degree of the pernicious type. The lancinating pains present in the stomach after eating, the loss of gastric and intestinal function (gastro-enteric atrophy) often makes higher feeding in these cases an impossible or dangerous matter. One should always look at the dual side of this subject in advanced cases of gastritis.

Bowels and Urine.—The bowels are frequently found abnormal. The common state is constipation, which, in the advanced cases, is most obstinate. A diarrhea may exist, particularly in those who drink heavily of beer or ale, or who have much intestinal fermentation and putrefaction. Alternating periods of constipation and diarrhea are occasionally met with; these cases, in my belief, should be looked upon more as conditions of constipation in which the diarrhea is a secondary matter to the constipation. The urine is usually rich in urates and phosphates, indican is commonly present, and albumin, uriniferous casts and cellular elements may be found in long-standing cases. The latter designates a chronic nephritis, a not uncommon accompaniment in long-standing cases of the atrophic type.

GASTRIC ANALYSIS.

While the diagnosis may be suspected from the clinical symptoms, a gastric analysis should always be made. This comprises the microscopic and clinical analyses of test-meals, of lavage water, or saline instillations from the empty stomach. Such examinations are not only necessary for the purpose of diagnosing a state of chronic gastritis, its type, and the proper treatment to be instituted, but are important in the prognosis and to watch results which are being obtained from therapy. Fortunately, much definite information can be derived from these laboratory findings, which, for the purpose of practical distinction, may be offered in the following types of cases:—

Simple Gastritis.—One hour after an Ewald test-meal the gastric contents show a lessened degree or in rare instances an absence of free and combined hydrochloric acid, a somewhat low total acidity, a juice of low enzymotic power, increased amounts of incorporated mucus, and the food is more or less imperfectly digested. The total quantity of extraction may be normal, or somewhat larger (70 to 150

cubic centimeters), and macroscopically the roll is found in large particles and the crust of the roll or bread in large pieces (poorly digested). When the acid secretion of the stomach is low, erythro-dextrin is present in small quantities, while achro-odextrin and sugar are abundant; this is due to the absence of the inhibiting effects of the hydrochloric acid on the salivary content and the more complete digestion of ptyalin on the starches in the stomach. The fasting stomach shows the rather constant presence of mucus and leucocytes in increased amounts. Sometimes with the normally present squamous epithelial cells, those from the stomach surface or tubules may be seen; these would be seen occasionally as columnar or more often rounded cells usually fixed in the shreds or rolls of mucus.

In moderate cases, the total hydrochloric acid falls to about one-half (30°); in marked cases it is lower or absent. As the acidity falls with it, the enzymotic content is reduced, although it may be present in increased amounts above the hydrochloric acid. Quantitative tests of the zymogens should always be made when the acid is low, for it is a practical fact, that upon these more so than on the reduction of hydrochloric acid much of the diagnosis of the degree of gastritis and prognosis depends. I am of the opinion that errors in hydrochloric acid secretion are more sensitive to gastric disturbance than are those of the ferments, and that general conditions, when the stomach is normal, can easily change the acidity while the pro-enzymes may be present in normal or only slightly reduced amounts. The zymogen secretions are the more specific functions of the stomach, to which the acid may be said to be auxiliary. Thus it is, that when the pro-enzymes continue low, it may be deemed that destructive changes have taken place in the glandularis and in the most numerous tubular elements in particular—namely, the central cells.

In the estimation of the quantity of pro-enzyme the complete peptogenic or the milk-curdling method may be used. For the pepsinogen and pepsin, the time-honored thermostated, water-jacketed chamber with the employment of Mett tubes in the filtrate answers well for the qualitative and quantitative estimations. The apparatus recently advanced by Einhorn (Chapter VII), which is a simplification of the Jakoby-Solms ricin method, answers to fair purpose; it is simpler, quicker, does not require a thermostat, but is not very, accurate. The details of performing these tests and the following are found described in Chapter VII. A quicker and simpler method and one of much value in ordinary clinical procedure is the simple test of quantitatively estimating the total enzymotic content by means of the amount of milk-curdling power present. It may be taken as a

standard that where the zymogen is present in $\frac{1}{160}$ dilutions much advance in the way of destruction in the glandularis had not taken place and that the results from treatment (and therefore the prognosis) are good; when it is necessary constantly to use a $\frac{1}{80}$ to $\frac{1}{40}$ dilution to obtain the reaction the prognosis is uncertain; and when it is not present in dilutions under these, particularly under $\frac{1}{20}$, the prospect of recovery is slight. It is desirable to make the complete pepsin estimations with more definite tests when close accuracy is desired, for one set may be somewhat different from the other, and if both were alike it is always of value in the confirmatory way.

What may be classed as the simpler forms of chronic gastritis are those which present changes from the above in the following manner: Cases are seen which show an excess secretion of hydrochloric acid (gastritis acida). These resemble in the amounts of acid a hyperchlorhydria with an increased amount of mucus. And because of this excess acid with enzyme, the gastric findings and clinical course are more of a sthenic one. In these cases, less importance should be placed on the gastric findings in the way of the acid-enzymotic content and its result on changing the macroscopic and chemical findings of the test-meal, and more should be placed on the amount of incorporated mucus and evidences of free cellular elements in the stomach. The distinction of this type of gastritis is important in the therapeutic way, since measures for the control of this excess of gastric juice secretion are important in the way of medical relief, but not in the way of prognosis. This type of gastritis is less a type of the common condition than those which begin in the asthenic way. It represents oftener, in my belief, a hyperchlorhydria causing a secondary gastritis, rather than a gastritis as a primary condition causing or being accompanied with a hyperchlorhydria. Still, it is possible that a chronic gastritis may in some irritative way cause an increased acid secretion for a while, and both a neurotic, a pure irritative condition, and organic disease might exist as somewhat associated conditions at the same time. The point here is difficult to prove, but there is no doubt that definite measures employed for the treatment of hyperchlorhydria are more successful in the curative way than those employed for a gastritis alone. The latter, however, in the beginning of treatment should not be neglected, for it is not so very rare that a long-standing gastritis acida may finally terminate in complete organic change of the glandulature and present itself as a true atrophic gastritis with no acid or enzyme or even mucous secretion in the stomach in the course of time. In these cases, while the increased amounts of acid and mucus are important to diagnose gastritis acida, the examination of saline instal-

lations or lavage water are more valuable to estimate the degree of actual chronic gastritis that is present. This form of gastritis is especially seen when there is a complicating gastric atony. The organic acids are not present in the stomach contents when the HCl is high. I do not recognize the so-called gastritis mucosa or mucipara as a distinctive clinical type of chronic gastritis.

Hypertrophic or Sclerosing Gastritis.—The stomach contents show the presence of food remains in various states of digestion and fermentation. Hydrochloric acid is markedly reduced in the free and combined acid; the organic acids are present in definite amounts, particularly when benign stenosis of the pylorus exists. Because of the contraction of the stomach as a whole in late cases, the test-meal return is small in amount (30 cubic centimeters or less). In other cases again, when the hypertrophy affects mainly the glandularis and submucosa, the chamber of stomach may be normal in size and even increased; in this event the return may be doubled or trebled. Food remnants and mucus may be present in the fasting stomach, since motility is usually tardy. Clinically, these cases are the same as those of the relaxed atrophic variety, for atrophy of the secreting apparatus of the stomach is always present and the gastric findings are like those described below. Blood is rarely found. Points of some value in making a distinction between the sclerosing and atrophic forms are the presence of mucus and food in the morning stomach of the first and the fact that the sclerotic stomach will not permit of the taking of large meals.

Atrophic Gastritis.—The fasting stomach is usually empty, both of food remains and mucus. The stomach here is merely a receptacle for food and hydrochloric and even the organic acids, the proferments and mucus all are absent. The Ewald test breakfast shows an absence of digestion, and, after being in the stomach an hour, still smells like roll or bread. Leucocytes and bacteria are present in increased amounts, and free nuclei are but rarely found. The return is usually increased in amount from the absence of gastric juice insuring stomach digestion and the interference with motility. Of great value in diagnosing atrophic cases is the presence of free gastric cells in the fasting stomach. Quoting part of a recent article of mine in which I drew attention to this, and in which I described the method employed in obtaining and staining for them, I present the following:[1]

In the atrophic conditions, this is made possible by a careful examination of the numbers, the type, and state of health of the gastric cells found free in the stomach. The text-books on the diseases of the stomach do not give significance to the value of such examinations. Here it is evident that we deal with the organic

cells of the tunica propria itself, and the technique, as well as the method of examination is simple. Since they cannot readily be made out in the thick mass of a test-meal, the stomach must be empty when we go after them, and this means the lavage of the jejunum mornings after a light supper taken early the evening before and a night of freedom from digestion. By these means the cells when exfoliating from the free surface of the stomach or desquamating from the tubules will collect in sufficient numbers for their discernment.

The technique that I have generally employed, and which was followed in the two cases herein reported, is the same as that described by me before ("Gastric Exfoliation as a Feature in the Production of Acute Gastric Ulcer." Medical Record, November 30, 1907). It is desirable to begin by aspirating the empty stomach before the ingestion of the compound saline solution. For this purpose I employ my regular test-meal bottle ("Test-meal Extraction," N. Y. State Medical Journal, June, 1908). The disturbing factor in the examination of such aspirated fluid as may be obtained before the giving of the saline water is that generally this fluid contains too much mucus for a careful scrutiny of the cells. Still, they can often be made out and then they are found not so much changed as they are liable to be when drawn hours later from the standing wash water, even when the compound saline solution had been employed. When any organic cells outside of the living body are subjected to the continued action of water they usually undergo a hydrolytic process, swell, change in contour, and do not stain as definitely as when in the tissues or when freshly drawn. The gastric cells are no exception to this rule. To prevent this, in so far as it is possible, it is desirable to employ for the washing purpose a solution which in character and specific gravity approximates that of the blood. This is done by the addition of salines. The installation that was used contained 250 c.c. of water to which were added 21 grains of sodium chloride, one grain each of sodium sulphate, sodium carbonate, and sodium phosphate. This is drunk, the patient is made to exercise vigorously, or the fluid is agitated in the stomach by sharp taps with the hand upon the abdomen over the gastric region, it is aspirated after five minutes and permitted to stand for several hours, the upper part of the fluid is syphoned off, and the sediment, in small lots, centrifuged for examination by the microscope. The stains which have served me best are one-half per cent. aqueous eosin, one per cent. methyl-eosin and hematoxylin, Biondi's polychrome methylene and carbol-fuchsin. I would recommend for general use eosin and hematoxylin in separate solutions.

The acid cells from the stomach stain readily with most of the aniline dyes. They are seen between the leucocyte and squamous epithelium in size and their main features are their confluent stippling of the cell protoplasm with eosinophilic granules and their well-defined nucleus. In shape, they may be described as irregular, although most of them are oval. With the eosin and hematoxylin stains, which serve well in differentiating the acid from the peptic cells (the first taking the eosin, the latter the hematoxylin), the nuclear membrane is usually well defined. The nucleus itself is usually lighter and a trifle larger than those in the peptic cells and stains in a blotchy way. These cells when desquamating in numbers are easy to find, and upon their presence the main dependence must be placed in the diagnosis of atrophic gastritis.

The peptic cells offer much greater difficulties in the way of their finding and discrimination than do any of the other organic elements found in the stomach. They stain poorly, the body just barely, the nucleus much better. With care and patience in the search they can often be seen, but never as plainly as the acid ones.

Their cell protoplasm is indistinct and with the hematoxylin stain is found faintly bluish in color. At best they take eosin or in fact any of the anilin stains, but very poorly. Their nucleus stains deeply and generally uniformly throughout. Neither the nuclear membrane nor nuclear granules can be distinctly discerned. This also differentiates them from the acid cells. The nucleus itself is seldom found oval as is often the case with the parietal cells. They are much smaller in size than the latter, being between them and the leucocyte, the mononuclear variety of which they may be mistaken for. Because their protoplasm digests away so readily (when

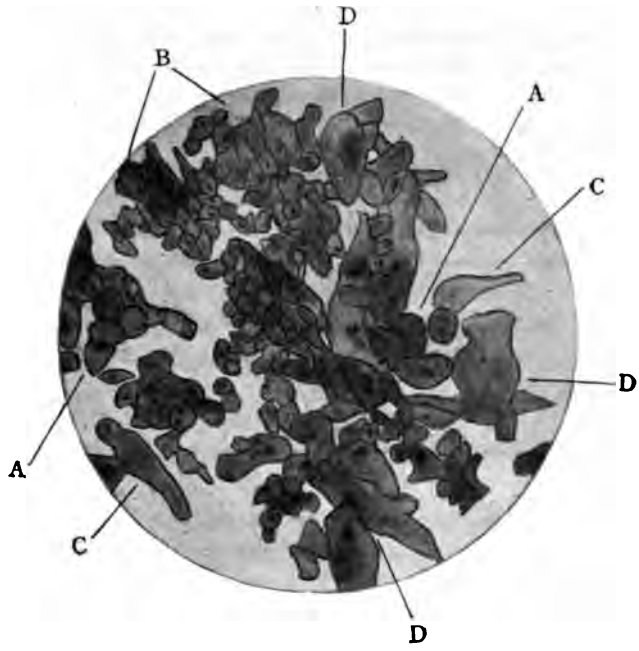


Fig. 88.—Photomicrograph of the centrifuged sediment of wash water from a case of atrophic gastritis showing numerous cells which had been shed from the gastric tubules. *A, A,* The acid cells; the right hand *A* points to two groups of the acid variety; below and to the right of the lower collection is seen a cast from a gastric tubule. *B,* A large collection of central cells; this group extends to the center of the photograph. *C, C,* Columnar cells, probably from the free surface of the stomach. *D, D,* Squamous cells from the canal above the stomach. × about 450.

the cells are free), and because of their poor staining properties and the question of their presence even if seen, the search for them need not be continued when numbers of the more plainly recognized acid cells are discovered. Sometimes they take the carbol-fuchsin stain better than they do the hematoxylin. Some of the free nuclei noted are undoubtedly from these cells, because I have seen such nuclei with just a shred or the faintest band of the characteristically stained protoplasm about them.

The columnar cells from the stomach are not difficult to make out. It must be remembered that in the posterior nares and the upper half of the pharynx the

epithelium is of the cylindrical variety and these may be shed and swallowed. The cilia of these cells would serve to distinguish them from the gastric epithelium. They stain better than the peptic cells, although not so well as the acid. Their shape is characteristic, their protoplasm is not granular, and they have a long, flat-looking nucleus which is almost in the center between the ends of the cell, while in the acid and peptic cells the nucleus is generally nearer to the edge of the protoplasm. They are easily detached by the stomach tube and thus are not so significant in this connection (unless exfoliating in large numbers) as the peptic juice secreting cells would be. They are often found in groups and hematoxylin stains them well.

In cases of atrophic gastritis particularly, there may be seen a ring of cells (cast) more or less complete, which, in my opinion, consists of groups from the depths of the tubules. Sometimes a mass of rounded or cuboidal shaped cells may be exfoliated from the lower regions of the infundibula and these would strongly resemble the above. The goblet cells are rarely found and are not difficult to differentiate from the true columnar.

CASE I.—January 3, 1906. T. B., age fifty-three years. Born in Ireland. Occupation, ex-policeman. Family history, negative. Personal history, had measles and diphtheria when a child. Fifteen years ago had a tapeworm which was removed. A second one was removed three years ago. Up to seven years ago he drank intemperately of alcoholic liquors, mostly whiskey; since then he has abstained completely. Other than his gastric trouble he has had no illness.

Gastric History: Had stomach trouble for fifteen years. During this time has had intervals of relief, longer in the beginning, but in the past year and seven months the distress has been continuous. First symptoms were weight and distress in the epigastrium after eating. In the past eighteen months lost 47 pounds in weight. "Began to get nervous just about the time the loss of weight started, now I'm irritable, don't know what I want or what to do, and cannot sleep nights." Has a craving appetite (bulimia) and whenever he takes food has a wild roaring and tumbling sensation in the stomach. Constantly belching gas which is odorless and tasteless. Feels very weak physically and cannot walk more than a few blocks without resting. Bowels obstinately constipated.

Physical Examination: Talks excitedly and has an anxious look. Seems to lack the power of consecutive thought. Weight, 141 pounds. Body shows that he has lost considerably in weight. Skin dry and sallow looking. Examination of heart, lungs, and liver revealed nothing abnormal. Urine contained one-half per cent. of albumin and a considerable number of casts. Has a well-marked gastric splash (three hours after breakfast). Greater curvature of the stomach lies above the umbilicus. The patient winces on pressure over the stomach and becomes nauseated when pressure is made in the epigastrium. Tongue coated. Was highly nervous and apprehensive during the examination.

Analysis of Ewald test-meal extracted the next morning. Looks well digested. Return 110 c.c. Incorporated mucus not increased in quantity. Congo and litmus negative. Free HCl absent. Combined HCl 3°. Total acidity, 9°. Starches well digested. Fehling's test for sugar positive and quick. A little lactic acid. A loop of the test-meal taken from the filter paper and examined unstained, showed a number of leucocytes and squamous cells, the starches in a good state of digestion, and no Boas-Oppler bacilli. Subsequent estimation of the quantity of enzyme with the Mett tubes and milk showed a very low digesting power of the gastric juice.

The next morning before breakfast I aspirated his fasting stomach and drew out 17 c.c. of thick fluid, which in examination consisted mostly of mucus (most of this was probably swallowed during the night). He then drank 250 c.c. of the combined saline water which was withdrawn, permitted to stand for four hours, syphoned down to 70 c.c., and which showed the following findings: Acid cells from the gastric tubules present in large numbers; some peptic cells; leucocytes numerous; free nuclei and mucus present in all fields; squamous cells abundant; some yeast fungi and short rod bacilli found.

Diagnosis: Advanced atrophic gastritis and chronic nephritis.

The subsequent history of this patient is worth relating. Under dilute hydrochloric acid, taken one, two, and three hours after his meals, acid gastric douches, a diet free from meats, eggs, and milk, his stomach at the end of two weeks showed a total hydrochloric acid acidity, after an Ewald meal, of 9° (all combined), and a total acidity of 13°. But he complained that he felt no better and had lost another pound and a half in weight. Although the results from his treatment seemed encouraging he felt otherwise about it, so he continued his rounds of private physicians and dispensaries until he landed a bed patient in one of the large general hospitals in the city. Here, a diagnosis of probable carcinoma of the stomach was made, an exploratory incision was performed (nothing malignant or surgical was found), and the patient died three days afterward of an acute exacerbation of his chronic nephritis, induced probably by the ether given at the time of his operation.

CASE II.—April 4, 1907. Miss M. S., twenty-five years old. American birth and of good family. Occupation, at home. Family history, a maternal uncle died of carcinoma ventriculi at the age of fifty-one years, otherwise negative. Personal history, was a seventh month child; had variola, scarlatina, and parotiditis when a child; began menstruating when seventeen years of age; had typhoid fever at twenty. "Never was strong physically." Habits good.

Gastric History: Had stomach trouble for seven years. It began shortly after her attack of typhoid fever and its onset was gradual. At times, when careful with what she ate, was comparatively free from distress. Various acute attacks in the past had been diagnosed as "gastritis," "nervous indigestion," and "weak stomach." Always felt best when away from city life. Complains of a sensation of weight and fullness in the epigastrium after meals. When the stomach is troubling her has much palpitation of the heart. Has often vomited a watery looking fluid (probably mucus). Has many attacks of headaches, pains and tired feeling in the calves of her legs. Has a bitter taste in her mouth mornings. Two years ago, when her stomach was not troubling her especially, she ate rather heavily one evening of chicken salad, after which she was taken acutely ill, had to go to bed, where she remained for ten days with a gastric disturbance accompanied with an elevation of temperature and which at the time was diagnosed as "gastric fever." Bowels constipated, but move with small doses of fluidextract of cascara. Has lost no weight.

Physical Examination: Weight, 127 pounds. Looks moderately anemic. Heart and lungs normal. Has a systolic hemic murmur over the body of the heart and a bruit in the external jugular veins. Blood examination showed 3,400,000 reds, 7000 leucocytes and 73 per cent. hemoglobin. Abdomen well formed but walls have poor contracting power. Lower border of the stomach 2 cm. below the umbilicus. Hepatic flexure of the colon and right kidney also displaced downward. Stomach very tympanitic. No splash on vibrating over the stomach, but slight

succussion sounds on shaking the body from side to side. Stomach apparently empty of food (four hours after a breakfast consisting of orange juice, a roll, and hot milk). An indefinite sense of distress on pressure in the gastric region, but no actual pain. Examination of urine showed a phosphaturia, otherwise normal.

Ewald test-meal extracted two days later. Returns 55 c.c. and looks like fine oatmeal water. Free HCl absent. Combined HCl 10°. Total acidity 14°. Starches well digested. Mett tubes showed poor proteolysis and milk-curdling reaction 1:20. Many yeast fungi and sarcinæ.

Examination of the sediment in the saline water (which was permitted to stand for five hours) showed many acid and peptic cells, a few columnar, one goblet cell of discolored mucus, an increased amount of leucocytes and free nuclei. Some of the gastric cells were perfect casts of the tubules.

Diagnosis: Advanced atrophic gastritis, and anemia.

Subsequent History: Under a carefully selected bland diet, tonics, general hygienic measures, and intragastric douching with a weak solution of silver nitrate, 1:1000, she improved perceptibly. Dilute hydrochloric acid taken after her meals had to be discontinued because of the distress it caused. The taking of fully peptonized milk with her meals helped in the general digestion of other foods taken at the same time. After four months of treatment, the acid cells were no longer to be found free in the stomach (on three occasions). She gained nine pounds in weight. Her highest acidity, after an Ewald meal, was found two months after the treatment had been instituted, and was total HCl 17° and total acidity 19°. On January 9, 1908, she again came under observation, having gotten acutely worse a short time before. The total HCl was then found to have dropped to 9° and the gastric cells were again found in the morning stomach as before.

Complications.—The most frequent one is extension of the process into the intestines. When this is present, a chronic duodenitis develops causing attacks of catarrhal jaundice from occlusion of the ductus communis choledochus or extension higher up in the gall-passages. Anemia and debility are often present, and in advanced disease inanition and emaciation are commonly seen. An intense general neurotic condition usually accompanies the atrophic cases, and states of chronic nephritis may be observed.

Duration.—The duration of a chronic gastritis is one of months or years. Much depends upon the degree of the disease, and the care patients take of themselves in the dietetic and hygienic way. The course is essentially a chronic one with improvements from time to time. With thorough and careful treatment, the mild cases recover in the subjective way, but even in these dietetic indiscretions may cause relapses. A better prognosis can be given if marked gastric or gastro-enteric atrophy has not occurred.

DIAGNOSIS.

This is made from the long course of the disease and the symptoms described. In atrophic cases the low general state of health, corporal nervous disturbance, anemia and nephritis are of importance. The

[illegible] secondary. The chronic [illegible] from the other gastric affections, [illegible] one another. As a [illegible] are easily diagnosed from each [illegible] passive disease in other [illegible] lungs and kidneys occur, it [illegible] gastritis might have been engrafted [illegible]

Fig. [illegible]—Case of secondary chronic gastritis due to cardiac [illegible] with [illegible] hypertrophy. Photograph showing a slight bulging of the epigastrium due to liver enlarged by passive congestion. A line shows the lower border of the liver which was soft. Patient gave a history of [illegible] disturbance and was not aware of the exact time heart condition [illegible] carcinoma had been diagnosed by one observer. The history, [illegible] of the epigastrium and absence of HCl in the stomach were probably [illegible] in this. Further misleading features in the case were a very intermittently heard soft blowing cardiac murmur (heard only when the patient was in the recumbent position) and a fair quality of pulse. The ascites was due to the passive congestion. Patient made a good recovery in bed [illegible] heart tonics and ceased to complain of dyspeptic disturbance afterward.

The acute forms are differentiated from the chronic by the history of the single taking of some irritating substance, the acute onset and short course, the more intense picture of illness and distress, the presence of acute nausea, vomiting, eructations and the febrile course. In the matter of diagnosing chronic gastritis from other gastric dis-

turbances much may be said. The characteristic picture of ulcer, carcinoma, and the neuroses should be kept in mind, always remembering that a chronic gastritis might ensue from any of them, or that it could have existed before these conditions developed and not directly be the cause of them—particularly ulcer and cancer. As a practical fact when ulcer or cancer can be diagnosed or is strongly suspected, the diagnosis of the more serious condition should always be made, and the gastritis looked upon in the lesser light. Frequent test-meal examinations will usually distinguish the true neurotic disturbances from gastritis. The presence of much mucus, gastric, epithelial and tubular cells, leucocytes, and low states of secretion in the way of hydrochloric acid and pro-enzyme speaks for a chronic gastritis. In the neuroses of a depressing nature more difficulty would be encountered, and more reliance should be placed on examining for evidences of free organic elements in the stomach and quantities of gastric mucus than upon low states of acid-enzymotic secretion.

In ulcer the pain is more acute, sharply localized, and increased on taking foods (particularly the coarser varieties). Hemorrhage from the stomach and vomitus containing much HCl are not seen in chronic gastritis. The test-meal analysis usually shows hydrochloric acid and enzyme in increased amounts, and a smaller return caused by the hypermotility of ulcer is of further help. With the chronic forms of ulcer more difficulty will be encountered. Here the states of gastric secretion may be low, including even mucus. The distinction then would be between chronic ulcer and late chronic gastritis. A past history of acute ulcer and the degree and character of pains are important, for in atrophic gastritis the pains are more diffuse, not so intense or frequent as they are in chronic ulcer. From carcinoma the differentiation may be difficult, but very possible when the series test-meal examinations, described in Chapter XXI under diagnosis of early gastric carcinoma, are performed. When a tumor is palpable, the gastric contents, and the characteristic general and other local symptoms of cancer are present, differential diagnosis is easy. The cases of hypertrophic gastritis which present a tumor cause much difficulty. The history of slow onset and the small, smooth, round, movable tumor, always remaining about the same in size, would suggest a benign condition. At any rate, as surgery is indicated in pyloric stenosing hypertrophic gastritis as well as in early cancer the distinction is not so important.

Amyloid degeneration of the stomach is always a secondary disease, occurring as a result of long-standing suppurations, tuberculosis, syphilis, and more rarely in leukemia, lead poisoning and gout. The

condition may manifest itself clinically as a chronic gastritis, and complete suppression of the gastric secretion may be present. Under such conditions, with the history of other disease and if the existence of amyloid disease can be established in the liver, spleen, or kidneys, its presence in the stomach may be assumed.

PROGNOSIS.

Chronic gastritis is a tedious disease possible of cure in the average case, possible of staying the progress and immediately relieving the subjective symptoms in the more advanced cases, and absolutely incurable and often discouraging to treat in the complete atrophic ones, in which it must be said that, when the intestinal mucosa is not involved or only slightly so, benefit, particularly general, may accrue from careful and steady medical attention. The less the quantity of running acid-enzymotic content, the more serious the case. The quantities of mucus present are not so much of a factor in forecasting this, since mucus is developed from the epithelium of the stomach and probably not at all from the parenchymatous cells of the tubules. The above remarks refer to cases that are properly treated, and who continue under proper régime after that. In those who after treatment again become indifferent to matters of proper eating and drinking, relapses are very liable to occur, and a further degree of gastric change may take place with each of such acute exacerbations. The secondary cases improve if the causative disease can be benefited.

TREATMENT.

Prophylactic.—The prevention of the disease implies avoidance of the causes which develop acute and chronic gastritis. Among these in part may be mentioned hasty eating and overfeeding, excessive drinking of iced drinks, the abuse of alcohol and tobacco (particularly chewing), bad condition and insufficient number and alignment of teeth, careful and long enough treatment in the dietetic way in acute gastritis, and close attention in the handling of cases of chronic disease of the heart, lungs, liver, and kidneys so that chronic gastritis is not liable to develop. Successive attacks of acute "bad stomachs" following the long indulgence of late evening heavy meals, or debauches in alcoholic drinks, usually develop first acute gastritis or neurotic disturbances and then a chronic gastritis in the end. A person who has passed through the course of an infectious or any long-standing disease may develop a chronic gastritis, either as a concomitant disorder in the stomach caused by the disease, or returning to the eating of foods improper for easy digestion before the stomach is capable of a normal power of digestion. Abundant and excess of caloric feeding for the purpose of establishing and storing up vitality,

strength and weight during convalescence, can always be safely met by using the fluid and softer forms of food, or the more solid varieties in proper states of fine subdivision.

Lavage.—The results from lavage are extremely good, and when combined with dieting forms the valuable combination of treatment. The most beneficial effects of washing the stomach are the dissolving and removal of both the free and adhering mucus, the removal of the mechanical embarrassment and the irritating delayed or stagnant contents of food, and the healthful stimulating effect it has on the glandular activity of the organ. It cleanses the organ in a surgical sense, and thereby prevents involvement of the intestines, and thus is an almost indispensable mode of treatment. When mucus is removed late in the washing it proved that it was freed from the mucosa. This removal is facilitated by allowing the water to run in under some pressure, a beneficial thing to do when atony is not present. The Leube-Rosenthal method is the best for accomplishing this, and in a positively empty stomach the gastric spray douche may be used with advantage. But when primary atony exists the hand syphonage apparatus is safer by delivering into the organ only small quantities of fluid at a time. The employment of massage of the stomach or changes in position during the lavage are of no essential benefit. It may be said that when the residual lavage water is from 500 to 1000 cubic centimeters marked atony of the stomach or a relaxed condition of the pyloric sphincter exists (permitting the escape of the water into the intestines). In the first, the weight of the contained water stretches the stomach walls, and this is injurious. In the second, the sudden influx of much water may be beneficial for a short time but in the end is injurious to the intestines. As Lockwood[2] has pointed out, when the residual water is due to primary gastric atony, an introductory treatment of intragastric faradism will strengthen the stomach to such a degree that lavage without having an excess of residual water becomes possible.

The best time for lavage is mornings before foods have been taken. In rare instances when the mucous secretion is high, a second late evening washing may be essential to get this excess secretion quickly under control. In mild cases or when benefit from lavage is definitely established, every other or every third day is sufficient. A short period of gastric rest after the lavage is desirable, and for this reason it is sometimes more convenient to lavage an hour or two before the evening meal. In other cases again its performance is best in the evening (9 or 10 P.M.), before the night's rest. The latter is the ideal time when, after the lavage, we put a mechanical sedative to

the mucosa into the stomach, like the bismuth salts, cerium oxalate or the insoluble and bland magnesia combinations.

In the matter of solutions for the purpose it may be said that better results in the removal of adherent mucus comes from the alkaline solutions than from plain sterile water or normal salt solutions. For this purpose there may be used 3 tablespoonfuls of sodium bicarbonate or 2 ounces of lime-water to 2000 cubic centimeters of warm water. Following this for its astringent and stimulating effect on the mucosa when much mucus is being secreted a 1 : 1000 solution of silver nitrate may be used. Care should be exercised that the stomach is empty after using this (argyrism) and it should not be kept up for more than a dozen or so washings. As the case progresses and the mucus seems to be lessened, it has been my practice to use with the discutient and antacid alkaline water, or just in solution alone, a weak solution of tincture of hydrastis (30 to 2000). While I confess to the empirical element in the employment of hydrastis, from its frequent use, I am convinced that much benefit can accrue from it in chronic catarrhal states of the gastric mucosa. The fluid-extract may be used in place of the tincture in about 4 or 8 cubic centimeter quantities in like dilution. For the purpose of stimulating hydrochloric acid secretion late in the treatment 12 to 2000 hydrochloric acid may be used; freshly made solutions should always be made up. It will be noticed that 2000 cubic centimeter quantities are suggested in all of the above. This is because most cases cannot be washed clean and the benefits are less with only pint, liter, or 1000 cubic centimeter amounts. The addition of antiseptics, like salicylic or boric acid, thymol, benzol or resorcin, are not necessary. When atrophy of the glandularis is complete no direct benefits can or ever do come from lavage.

Dietetic.—The regulation of the diet is of great importance in the treatment, and a diet list based on the chemical condition of the individual's digestive power and free from substances which might irritate the mucosa should always be given and its observance insisted upon. The best plan to follow until the symptoms abate somewhat is a fluid or semifluid diet consisting of bland and easily digested substances. Among these may be mentioned milk, koumyss, matzoon, rice, farina, sago, soft eggs, thin soups, mashed potatoes or soft vegetables in purée or cream, spinach, scraped or finely chopped meats, not very fresh bread, toast, butter and cocoa, etc. In a week or two the diet should be added to by including articles of a more solid nature. The eating of meats, rough vegetables and fiber-bearing cereals (like oats) should be resumed with caution, and it is best for these to be

severely limited. Stimulants, highly seasoned food difficult of digestion (pork, new veal, corned or smoked meats, lobster, salads, pickles, cabbage, cucumbers, etc.), too hot or too cold drinks, coffee or strong tea should not be used. In those accustomed to it, the breakfast cup of coffee may be continued, but none after that during the day. In normal or increased acidity the protein-bearing foods are allowed, while if the acidity be low, only the softer forms, like fish, eggs and milk should be used, and the carbohydrates and cereals increased both to spare their proteins and because of the better digestion of the starchy substances. In severe cases, only the fluid or finely subdivided foods should be allowed. In constipated cases the soft green vegetables, fresh fruits, honey and buttermilk, etc., are of service.

As to the number of meals a day much depends upon whether atony is present or not. If it is, frequent meals (four or five a day) and each of small amounts are best. If it is not, the usual custom of three meals in a day is best. Three meals of smaller quantities are always better than only two larger ones.

The teeth should be looked after and insistence be placed upon slow eating, thorough chewing and complete insalivation before swallowing. Distracting thoughts at the table should be avoided, and for this purpose congenial company is helpful. The well-nourished, habitually overfeeding patients should stop eating when a feeling of satiety occurs, or should accumulate a fair amount of food on his plate before beginning to eat, and stop when this is gone. Alcoholic drinks and bitters in any form had best be forbidden absolutely. The general health should be closely watched, and when this is low or fails more food should be allowed. After the course of treatment, a diet list of "must not take" serves to the best purpose. It is simpler, less difficult to follow and less easily forgotten. In this connection the following is offered:—

Foods that will be essentially injurious and must not be partaken of are: one- or two-minute cooked breakfast foods; the rough vegetables—cabbage, sprouts, cauliflower, artichokes, asparagus, beets, celery, corn, cucumbers, kohl-rabi, onions, and tomatoes; foods which contain pits, seeds, skins, or nuts; canned and smoked beef or fish; lobster, crabs, shrimps; cheese of any kind excepting Philadelphia or Neufchâtel; too much pastries, especially those cooked in molten fat, like doughnuts, fritters, etc. Foods that are too sweet, such as jams, etc.; also fruits, cherries, cranberries, figs, grapes, muskmelons, and much coffee, strong tea, alcoholic and malt beverages.

Balneological.—The use of proper mineral water for the case is of much value for the reason of stimulating glandular activity, on the one

hand, and neutralizing high acid secretions, on the other, as the case may be. To stimulate secretion, the saline waters and those containing carbonic acid gas are of the most service. Among these may be mentioned Kissingen (Racoczy), Kochbrunner, Homburg, Fachingen Soden, or the American carbonic acid charged water of Saratoga (Congress Spring). When the secretion is absent these waters are of no benefit. When the acid content is high the alkaline waters are useful. Among these are Vichy Célestine, Weisbaden (Kochbrunnen), Victoria-Brunnen, St. Galmier and Saratoga (Hathorn). In anemia and the presence of atony, Levico Mild, Mitterbad, Orezza, Schwalbacher or Stahlbrunnen may be used. In constipation Carlsbad, Villacabras, Pluto, or Mt. Clemens Bitter Water, although it is better to get the bowels to move by dietetic and hygienic means, or by enemata of small amounts of olive oil instilled into the rectum each night, or saline enemata during the day. The saline waters should be drunk before, and the alkaline and ferruginous during or after the meal. The aperient water should be taken on an empty stomach, preferably before breakfast. Patients of a nervous or debilitated nature should not be allowed to partake of purgative water. The reason that sojourners at foreign spas with chronic gastritis improve so markedly is not so much because of any direct beneficial effects from the drinking of special water or the taking of same in a fresh state as it is to the freedom from business and worry while there, the more regular régime in eating and rest, the better selection of foods, absence from drinking dissipations, the outdoor life, and the large quantity of water partaken of causing the steady washing out of the stomach and emunctories of the body.

Baths.—A morning cold sponge bath is of much service in the depressed cases and in phlegmatic people. It has a beneficial effect on the general body in the way of working up tissue resistance by stimulating cellular oxidation, and in many instances improves the general status of digestion. For this purpose, cool plain water of about 60° F. may be used, although the addition of salt is desirable for its greater tonic action. For the latter, sea or kitchen salt in proportions of one pound to ten gallons of water is about proper. My experience with the salt-water baths has been that patients sensitive to the application of cold react quicker and that it has a more exhilarating effect than when plain water is used. Thus it is that these may be used in reduced general states of the body when plain water would not be well borne. In the giving of sprays of a lower temperature than 60° F., the standing in a few inches of warm water somewhat mitigates the shock. A cold rub is possible in any home, since

only a basin containing the water and a thick towel are necessary. This is to be preferred with very sensitive and nervous persons, since with the application of the wet towel less water is applied and a little rubbing may be employed at the same time to bring on a glow. The warm baths of ten or fifteen minutes' duration may be used for a soporific effect in insomnia and agitated states of nervousness. The spinal hot sponge bath lasting for fifteen to twenty minutes is valuable to induce sleep. Complete warm baths once a week may be used for cleanliness.

Exercise.—Outdoor exercise is of much value in the care of these patients. Of these may be mentioned walks, particularly in the outlying districts of the city, horseback riding and rowing. Automobiling is of less value. In the home, gymnastics may be carried on by the use of light dumb-bells, wall exercises, or going through the United States military setting-up exercises for ten minutes each morning and evening. It is well to insist upon the carrying out of these exercises in a medical way or patients will soon become very indifferent to them. To obviate this, a daily visit to a well-ordained gymnasium where company during the exercise is readily obtainable is of service. For our men and women of the upper classes, the recently projected city tennis clubs are to be recommended. When there is visceral prolapse the set of abdominal exercises given in Chapter XII is of value; likewise also, any exercise, such as tennis, which brings the abdominal muscles into play.

Rest.—In the sthenic forms of chronic gastritis the care of the nervous system may require special attention. To this end, retiring early in the evenings, at 8 or 9 P.M., and arranging so that ten or more hours' rest in bed be taken daily is worthy of adoption. In patients who have lost weight and are reduced in strength and vitality, gymnastics should not be engaged in, and a "food and rest cure" may be necessary.

Electrical.—The employment of electricity comes next in importance to lavage and dietetics. The use of the faradic current of rather slow interruptions is most beneficial. By its use the subjective symptoms often ameliorate, and the general tone of the stomach, particularly the muscularis, improves. The galvanic current may be employed in cases of acid gastritis when no atony is present. The intragastric method of administration is vastly to be preferred to that of the percutaneous. The course of treatment should last for two or three months; in the start, treatments every other day, then every third, every fourth, and so on until the relief is permanent. The technique of giving these treatments is contained in Chapter XII.

In nervous cases, in addition to the massaging influence of the faradic current, a marked psychic and general stimulating effect is often accomplished. In these cases the spinal and neck regions should be treated with the external electrode. In cases of poorly developed and relaxed abdominal walls (ptosis), and when atonic or atrophic constipation exists, the general abdomen should be treated.

Medicinal.—With proper dieting, lavage, mechanical treatment, and possibly electricity, there need be little resort to drugs. As our knowledge of the rational case of gastric conditions advances, medicants seem to be less and less in order. In some instances, however, for the treatment of special symptoms they may be used. Among these is the use of hydrochloric acid to meet the secreting shortage and stimulate the glandularis to activity. Agreeing fully with Ewald as to the value of this acid in these conditions, I still doubt that it need generally be used in 40 or 60 drops of the dilute acid to obtain good results. In some few cases it is advisable, but my experience has shown that in those cases wherein it would seem to be distinctly indicated—atrophic gastritis—such large doses are liable to increase gastric distress during digestion rather than relieve it, whereas 10- or 20-drop doses might be well borne. The best plan of administration is to give from 10 to 20 drops of the dilute acid in a glassful of water, drinking one quarter of the amount at half-hour intervals after the meal. The addition of pepsin to this, or used alone, is of no practical value. Pepsin not secreted fresh from the human stomach during digestion cannot be made good by the giving of any commercial preparation of pepsin. Its use together with predigested foods should be discouraged.

According to the gastric findings in test-meals, and keeping the pathology of chronic gastritis in mind, the following are worthy of employment. The bismuth salts, subnitrate and subcarbonate, are direct mechanical sedatives to irritated mucosæ. The subnitrate is best for the ordinary case, but the subcarbonate has an alkaline advantage over it for gastritis acida. They should be used in larger sized doses than they are ordinarily employed (1.0 to 2.0 grammes), and the subnitrate should always be taken before meals or when the stomach is empty. One large dose of bismuth subnitrate (3.0 grammes) taken at bedtime is an excellent practice in the running treatment of these cases. It must be remembered that when constipation is a marked feature in the case or occurs from its employment bismuth should not be used. In some instances, however, the corrected employment in the following is recommended:—

℞ Magnesii usta.	10.	ʒiiss
Bismuthi subnitratis	20.	ʒv
Aquæ destillata	200.	℥vj

Fiat et Sig.: Take one tablespoonful half hour before meals.

Or in gastritis acida:—

℞ Magnesii usta.	10.	ʒiiss
Bismuthi subcarbonatis	20.	ʒv
Mistura rhei et sodæ	200.	℥vj

Fiat et Sig.: Take one tablespoonful half or one hour after meals.

When the secretion of mucus is high, lavaging with silver nitrate solution is beneficial. In these cases it is my custom to first wash out the stomach with 2000 cubic centimeters of an alkaline solution, and then follow this immediately with 1000 cubic centimeters of a 1:1000 silver nitrate solution. By employing an irrigating stand holding a two and a one thousand centimeter glass irrigator, side by side, this is quickly done by having short tubes from each glass jar. When the alkaline solution has been run through the stomach, the tube from that jar is slipped off the Y tube, and that from the silver solution is put on in its place; a four-armed glass connection holding all rubber tubes is even better.

In atrophic gastritis when the acids are not well borne, foods suitable for intestinal digestion should be advised and the stomach kept alkaline for this purpose. To these ends sodium bicarbonate, magnesia usta, and sodium carbonate exsic. may be used with the meals, which, it may be said, should be frequent, small in amount and finely subdivided. Pancreatin given along with the alkalies is of value.

Treatment of Special Symptoms.—In the treatment other than above described may be mentioned the following: For anorexia—lavage, nux vomica, condurango, gentian and orexin. For nausea and vomiting—careful dieting and lavage, hot applications to the abdomen, cerium oxalate and chloral (0.15 gramme) in chloroform water 4.0 grammes). For pain—fluid diet or short abstinence from food, lavage, hot applications, galvanism and bromides. For deficient gastric juice—lavage and dieting, dilute hydrochloric acid, nux vomica, gentian, and general tonic measures. For motor insufficiency—electricity, hydropathy, frequent small meals and nux vomica or strychnine in rather large-sized doses. For psychic depression—electricity, cold sponge and surf baths, general tonics, high caloric feeding and a sojourn in the country or in a well-ordained sanitarium for digestive diseases. For constipation—proper dieting, electricity, exercise, going to stool regularly whether the bowels move at the time or not, the use

f pulvis glycyrrhiza compositus, cascara sagrada, or rhubarb, rectal nema of salt water, and not at all the strong purgative pills or tablets xcepting only in occasional instances for the purpose of cleansing ıe bowels.

REFERENCES.

[1] BASSLER: "Significance of Wash Water Examinations for Gastric Cells in ıe Diagnosis of Atrophic Gastritis—Report of Two Cases," Medical Record, July l, 1908.

[2] LOCKWOOD: "Practice of Medicine," p. 405.

CHAPTER XX.

Organic Diseases of the Stomach.

(*Continued.*)

GASTRIC AND DUODENAL ULCER.

PRELIMINARY REMARKS.

SINCE Cruveilhier first pointed out (1829 to 1835) that gastric ulcer was a distinct clinical disorder and not a condition due to post-mortem change as was supposed at the time, this disease has been variously described as Cruveilhier's disease, round ulcer, ulcus ventriculi, perforating ulcer, peptic ulcer, simple ulcer, and others. According to our knowledge of the condition to-day, it occurs to me that the terms simple ulcer or peptic ulcer are the best, since these refer to organ situation and the anatomical lesion, and in the second instance to the fact that the presence of gastric juice in that portion of the digestive canal is no doubt a prominent factor in the etiology of the great majority of them.

A perusal of the historical records of this disorder proves that although instances of patients with gastric ulcer are available from the sixteenth century (and even suggested in the tenth century), it took from the time of Matthew Baillie in 1793 through the entire last century and up to the present time to have developed the knowledge on the subject that we now possess. Of late years, because of the vast interest and importance of the condition both from the medical and surgical standpoint, the many more skilled workers who have come into this field of study, the advances in measures of diagnosis that have been made, and to the development of upper abdomen surgery (mostly by the English and American surgeons), the subject is receiving world-wide attention.

Statistics in regard to the frequency of gastric ulcer on the whole are quite valueless. The reasons for this are that the presence of the condition in the number of cases that are definite enough to come under clinical observation comprise only the minority, possibly not more than 25 per cent. of all cases that exist. The combined statistics of nearly 400,000 patients show ulcer to have been diagnosed in less than 1 per cent. of the cases, while in the combined statistics of 59,450 autopsies of various series evidences of healed or unhealed ulcer were observed in 4.4 per cent.; I have no doubt that with our better knowl-

edge of the condition in recent years, this vast disproportion is being materially cut down. Taking the countries in which ulcers are more commonly diagnosed (Germany and England 5 per cent. each, and Denmark 16.5 per cent.), and comparing these to the others (Russia 0.8, Switzerland 2.6 and North America 1.3), I believe that future years will probably show a more even proportion in countries or cities on the same longitudinal lines, and that the cases will be met with more numerously as we ascend or descend from the equator to the frigid zones. It is possible that, according to the habits and environments of people in each community and to the status of medical men in each locality, statistics on this will continue to show variations for a number of years to come. As a cause of death, ulcer occurred in 410 out of 444,564 deaths (Martin); these figures no doubt pertain to the more or less definite and short duration cases and not through all of the sequent conditions.

The condition occurs more frequently in women than in men in about the proportion of 3 to 1, and most of the cases met with are those in the third decade of life, although no age is exempt. In this way it differs from cancer in that the proportion of male cases usually predominates and that those between fifty and sixty years of age are most liable.

ETIOLOGY.

Gastric Juice.—Considering that no bacteriological factor in the way of producing the specific and characteristic lesion in the glandularis has been observed or discovered, I still feel that the gastric juice with a low or absent mucous secretion must be considered as the most important factors in the production of ulcer in the great majority of cases. I base this upon the well-known post-mortem change in the glandularis which the gastric juice can bring about (autodigestion), the fact that normal or hyperacidity is met with in the majority of cases, and its secretion has such a deterrent action upon the healing of the lesion, and that gastric desquamation or exfoliation or erosions are so commonly met with as stomach disorders. The facts, as Ewald, Lenhartz and others have shown, that ulcer can exist with a sub- or an-acidity is no argument against the gastric juice being a direct cause of the production of gastric ulcer. Particularly is this so when you take into consideration the more important fact that hydrochloric acid even in a normal person is a very variable secretion—at one time high and at another time absent, and what would be a normal acid secretion in one person may for another be a too high or too low secretion. The acid itself is chemically not able to digest animal tissue

or food, the main enzyme ferment is the essential for this, and it is possible that this product is more directly concerned in the loss of stomach tissue than just the acid, which, even if short or absent, could be replaced by other acids taken in the foods. It is a striking feature that this type of ulcer is only found where gastric juice flows or in the adjacent organs that it comes in contact with, namely, the stomach, the first part of the duodenum and lower end of the esophagus. Nowhere else in the alimentary canal is the same character of punched-out lesion met with. Once beyond the middle portion of the duodenum, the chyme is neutralized and from here down these ulcers are not encountered. When the lower colon is reached the contents are slow in the passage and usually become acid again from fermentative products and it is more probably due to this, with the presence of stomach enzymes which have been passed down and are incorporated in the feces than to local bacterial infection, that about the same type of ulcer (stercoral) may exist in the sigmoid. In the production of simple gastric ulcer some irregular course of secretion deep in the gastric tubes, or retention of secretion near the submucosa may cause a deprivation of nutrition at that site with a protective thrombosis in the submucous venules or trunks, and that in the process of motility of the organ this damming of circulation may be extended until a considerable portion of the glandularis is deprived of circulation and sustenance and thus is digested away with the production of an ulcer; the fact that these ulcers are essentially a necrosis and are usually situated near the pylorus or in the pyloric region of the stomach where the tension for outlet is greatest, the chyme the most fluid, and the acidity most marked are somewhat in favor of this being so.

While hyperacidity in itself is generally recognized as an insufficient cause to produce ulcer, on five occasions I have observed the development of ulcer in cases in which an excess secretion has been of long standing. I feel that a high status of secretion can assail the gastric mucosa from the interior of the organ, although I believe that trauma from foods, thermic and chemical agents can also be internal factors. These in a group can be considered as direct causes, while any outside factor, such as anemia, thrombi, emboli, disease of the arteries, lesions of the vagus, and inflammatory changes in the gastric nerves may be looked upon as agents which would lower the resisting vitality of the glandular layer of the stomach to the factors from within.

In a series of eighty-three specimens of saline instillations that I examined for gastric cells, twenty-nine of which were from seven cases of excess secretion and eleven from cases of the so-called gas-

tritis acida, I was able to prove that gastric exfoliation was very much more common than is ordinarily supposed. The columnar cells were on some occasions found in every case of plain excess secretions and sometimes in great numbers in each specimen. In five of the cases I found groups of cuboidal or irregularly rounded cells attached together, cells which most probably were from the gastric tubules. In one of the specimens, from a case which showed a free HCl 56°, combined HCl 80°, and a total acidity of 111° in the test-meal, I saw a single-sided section through the infundibula of a tubule with columnar cells on one end, in the middle shorter and wider ones, and at the other end cells from the interior of the gland. It seemed also to be proven that depending upon the quantity of mucus in a hyperchlorhydria the glandular layer of the stomach was protected against the exfoliating work of the acid, for I observed that when the secretion of acid was decreased and the mucus increased to a more normal quantity the exfoliation of the cells subsided. In this connection I report a significant case which was included in the publication of the observations at the time:[1]

E. M., Sept. 20, 1906. Age 24 years; married; no children; housewife. *History, Family:* Father killed at 47; mother died at 54, cause unknown. *Personal:* Dysmenorrhea since puberty; pneumonia five years ago; drinks four or more cups of tea and one of coffee each day; otherwise habits good excepting confined to the house too much; had gastric disturbance more or less for four years. More distressed during the past three months; habitually constipated. Present—troubled much with eructation and distention after meals, particularly after dinner; has pyrosis and regurgitates acid fluid after meals. Physical examination shows a well-nourished woman; mucous membranes good color; tongue thinly coated with red edges and tip; patient nervous and apprehensive; epigastric distress on pressure; intestines moderately distended with gas; fecal mass in sigmoid. *Analysis,* September 21, 1906. Ewald test-meal, expression easy, return 110 c.c., looks poorly digested, very little odor, no incorporated mucus on gross inspection; total HCl 121°, total acidity 133°. Urine amphoteric and heavy in phosphates, otherwise normal. *Diagnosis,* hyperchlorhydria.

On the morning of the next day, when fasting, drank 240 c.c. of saline solution which was left in the stomach five minutes and aspirated. 75 c.c. of the return was examined and showed as follows: fluid distinctly acid (HCl) and bile stained; no mucus apparent and no food particles visible. After standing three hours specimens from the middle zone were examined in lots of 10 c.c. which were centrifuged for two minutes or more and showed the following findings—large numbers of squamous cells, numerous free nuclei, considerable columnar cells and a few cuboidal ones from the gastric glands, one group of columnar cells (seven or more in number) were seen; cuboidal cells were found in several groups attached together; a few sarcinæ, some shreds of mucus, few mucous corpuscles, and particles of detritus. Specimens from the bottom of the stand glass showed the same cellular findings as above stated, excepting that there were more of

them with the addition of numerous rolls of yellow stained mucus, a few vegetable and partly digested starch granules, and more detritus.

On October 7, 1906, I saw the patient, who, under the prescribed high proteid diet and a compound powder of alkalies claimed she was quite well again, although analysis showed that she still had the hypersecretion and exfoliation of gastric cells.

Ten months afterward (July 9, 1907), I was called to her home and I learned that nineteen days before (June 20) she had been delivered of a seven months viable fetus after the third uterine hemorrhage in five weeks. On June 19, while asleep, she had an exsanguinating hemorrhage, followed by syncope and semi-consciousness lasting for nearly two hours. The attendant diagnosed a placenta prævia, tapped the membranes, packed the vagina with cotton, and on the next afternoon she miscarried. The early post-partum course was normal, excepting that the woman remained obstinately pale and peaked-looking. Six days after her delivery she began to complain of pain and distress in the epigastrium after eating. The pains continued more or less depending upon the character and amount of food she took, until the day before my visit, when, her stomach feeling somewhat better, she partook rather heavily of raw fruits and after which she was seized with severe gastric pain and vomited. The pain grew worse during the night and the next morning after taking a glass of ice-cold milk she vomited considerable blood. The history, the physical examination and subsequent course of illness showed that it was plainly a case of ulcer of the clinical type.

My deductions from the case were that the hyperchlorhydria, from which she suffered more or less for years, caused an exfoliation of the cellular elements of the gastric mucosa. This exfoliation continued, and, like small traumas from food, was not serious as long as the nutrition of the stomach was sufficient to repair the slight abrasions. But when as a result of severe hemorrhage the system became impoverished and devitalized, the resistance of the basal membrane and submucosa was lowered, and, the acidity continuing, an ulcer ensued on an exfoliated area. This seems to me more rational than a blood clot carried from the uterus which lodged in the stomach, or other reasoning.

Trauma.—This may also be considered as a direct cause. It may be externally or internally exerted, the latter arising from mechanical, chemical or thermal irritants. Of these, the mechanical seems to be the most plausible, because by the thermal or chemical agents the ulceration is usually different in character (more superficial and diffuse) and that these ulcers are rarely met with in the fundus where such substances would first exert their influence after having passed the gullet and cardia, which latter, it may be said, are just as amenable to the baneful effects if not more so than the stomach. It is probable that, under favorable conditions of motility in the way of tight approximation of the mucosa to a sharp surface, like that that may be offered by the points of grape and tomato seeds, shells or the lining interior of nuts, certain whole grains, etc., slight trauma could ensue, which, under high stomach acidities, may be delayed in healing or be the cause of deeper erosion and finally distinct ulcer

formation. According to Richardière, traumatic ulcer cases are classed in two groups, one the acute cases healing rapidly, the other (because of the condition of the gastric juice) cases running a course similar to ordinary chronic ulcer. The latter condition in the stomach mucosa and submucosa (which are most vascular structures during gastric digestion) can in the early instance be accompanied by local hemorrhage and later the surrounding infiltration for repair, both of which conditions could cause a functionating inactivity of that portion of the glandularis for the time being, while the normal mucosa elsewhere is secreting its full quota of digestive secretion. It is plausible to me that in such conditions an autodigestion of the affected portion may occur—probably gradually and through successive gastric digestions—with the formation of an ulcer which is limited in size and shape according to the better status of independent circulation in the glandularis or submucosa at the periphery. It has been shown by Matthes that when bits of mucous membrane were removed there was a tendency of the muscularis in these regions to contract and thereby bring the edges of the mucosa together and thus protect the bared portion against the action of the gastric juice. Food traumas or local circulatory conditions causing erosions occurring in parts of the stomach where the redundant mucous membrane is less of a feature of structural make-up (such as the lesser curvature and pyloric region) offer a greater liability to ulcer, and these are the locations in which the acute ulcer is most commonly found.

An outside traumatic factor, such as violent emesis, severe compression, a direct blow over the organ, or a severe shock to the entire body, may, particularly when the interior layers of the stomach are friable with blood during gastric digestion and the organ laden with food, cause an injury and a dissolution of the mucosa. It is well known that the intestines can be rent through all of the structures from a severe direct or indirect force, and thus it seems reasonable to believe that the stomach, which is also not tightly moored in its intermediate part, could also suffer in the same way, although, no doubt, not to the same degree of severity or danger. It is probable, as Ackerman has shown, that epigastric compression is a considerable factor in producing ulcer; among such may be mentioned the instances of ulcer in women who use the fashionable waist-compressing corset which does not allow the lower and intermediate portions of the organ to distend when foods are taken and thus presses upon the pyloric region particularly when this is low, and tailors and shoemakers, who, because of their positions and occupations, are subjected to upper abdominal pressure.

Among the indirect causes may be mentioned the several factors which could lower the resistance or possibility of repair of the glandularis.

Circulatory System.—S. and W. Fenwick, Riegel, Mayo and others hold that a definite relationship exists between ulcer and chlorosis and anemia. Whether the sequence, as Riegel suggests, is brought about by the hyperacidity that is so common in chlorotic anemia, or, as Cabot and Stengel have stated, that the anemia is secondary to unrecognized hemorrhages it is impossible to say. It is probable that each of these views is correct in individual cases, although as far as can be gleaned from clinical observation to-day the view of Riegel answers best for the majority of instances. There is no doubt that in the largest number of cases seen anemia is present, and that the treatment of this is a most important factor in the cure of ulcer. Mayo believes, and I have proven this to be so in my own observations, that by treating the anemia one can often cure the ulcer. I personally believe that anemia should be viewed as an indirect cause in the way of lowering resistance to the effects of gastric juice or the ability of repair of stomach abrasions.

Arteriosclerosis and endocarditis are considered as factors in a number of cases. Howard observed that sclerosed vessels were marked in 48.8 per cent. of his cases, and others have reported the same but usually in lower figures. According to information in clinical work that can be gained by the examination of the palpable arteries and observations with the sphygmometer, I feel that Howard's statistics are high for the average case. Most of my patients were rather young to expect much if any arterial change, and endocarditis was not encountered as a relative factor. It seems rational to believe, however, that in the truer forms of chronic ulcer seen in the middle aged and old these conditions are of more moment as causes for the condition than in the second or third decade of life.

Emboli from heart lesions, etc., might cause the development of ulcers as they do infarcts in other organs (Virchow); a number of observers with various kinds of injections and methods (Orth, Panum, Cohnheim) have observed this to be true providing the stoppage of circulation was confined to a limited area of the stomach. Localized thrombosis caused by internal injury may be offered in the same connection. However, embolic conditions are not common, and it is probable that, like sclerosis, embolism is more of a factor in those of advanced age than in the young. Furthermore, it occurs to me that unless the emboli were infectious in nature, and thus capable of additional local destruction of tissue after lodgment, or large enough in

size so as to cut off much circulation, the rich network of collateral circulation in the organ would protect the glandularis from the intima side.

From as much as has been stated it is plausible to suppose that submucous hemorrhages and hemorrhagic erosions due to disease of the mucosa (chronic gastritis) or injuries to it exerted by agents interiorly applied and which cause local hemorrhagic or infiltrative results, or, on the other hand, the interference with local circulation and the subsequent digesting action of gastric juice on that area, such as may be produced by emboli, carried infections or thrombi in chronic heart, liver and kidney disease or the acute infections, in individual instances, are causes for the production of gastric ulcer. It also seems reasonable to suppose that although carried infections (such as may occur in appendicitis, cholecystitis, pyemia, syphilis, or tuberculosis) can cause gastric ulceration by secondary infections, and that, although bacterial invasion of the tissues of the ulcer base is commonly observed, this in the acute ulcers is usually a secondary infection from the interior side after the ulcer had been formed.

Among other causes that have been advanced for the production of gastric ulceration are local anemia from arterial spasm either by itself or from muscular contraction of the gastric muscularis exerted upon the traversing arteries (Klebs); diminished alkalinity of the blood (Pavy, Jaksch); injuries to the nervous system particularly the cerebrum (Brown-Séquard, Schiff, Ewald and others) or the vagus (Talma, Yzerin) or the celiac axis and splanchnics (Vedova); and the most recent offered, the failure of the gastric epithelium to produce an antibody, "antipepsin," or the destruction of this by the hyperacid media causing the loss of immunity from autodigestion (Weinland, MacCallum).

PATHOLOGY.

An ulcer is a dissolution of surface tissue comprising in so far as the interior of the stomach is concerned all the distinct forms of ulcer, erosions (which are superficial ulcers), ruptured vessels (varix), and, if it is ever proven that these can exist, also fissures.

Distinct ulcers of the stomach may be funnel-shaped or crater-like and quite deep, or circular, oval, irregular, linear, or terraced and superficial in form. The acute ulcer is usually soft with slightly rounded edges, while those that have persisted for some time and been irritated may be quite stiff (particularly at the edges) from round-cell infiltration and hemorrhages and connective or scar tissue deposit (a form of chronic ulcer). The base is usually smooth, but may dis-

play uneven points due to the free ends of tissues or transverse muscle fibers of the inner muscular coat. The base is generally covered over with a greenish or brownish tough mucus, and may be the lodgment of a more or less tough blood-coagulum which is torn away with some difficulty. The small superficial ulcers (erosions) often show no deposit on the surface, and being the color of the mucosa may escape detection unless carefully sought for with the aid of a magnifying glass.

The simple ulcers vary in size from 1 centimeter to 3 or 4 centimeters in diameter, some being much smaller and giving the gross appearance of ruptured follicles, and others again (particularly when several coalesce into one) are much larger, comprising great areas of the stomach mucosa. They are usually single but often multiple, and may be found only in the stomach, first part of the duodenum, or lower end of the gullet, or in any two or in all of these organs in the same case. They are most often situated in the lowest parts of the stomach (standing position) in the pyloric and lesser curvature regions, are encountered less frequently as the fundus is reached, although no part of the organ is exempt. Statistics as to the most numerous sites of ulcers vary to such an extent that they serve to no definite purpose excepting in the way that all agree that the posterior wall and lesser curvature of the pyloric region make up about 65 per cent. of the instances, that those directly at the pylorus come next in frequency, and that of the frequency with which they are encountered in other locations, it may be expressed about in this order—anterior wall, cardia, fundus and greater curvature. Fenwick's statistics on the three zones give:—

	In 70 Chronic Ulcers.	In 39 Acute Cases.
Pyloric region	53	13
Middle zone	7	14
Near the cardia	10	12

Microscopically the margins of a fresh ulcer are usually clean cut with but very little inflammation or evidence of healing. The edge of the loss of tissue is usually abrupt through the entire depth of the glandularis with the submucosa or the circular muscular fibers as its tissue base. Near the bottom of the edge there is generally a gentle depressing slope toward the center of the ulcer made up by deposit of mucus, detritus, bacteria, blood-cells, and molds which collect under the shelving edge. In the older ulcers there may be a reactive inflammation at the periphery with the formation of a calloused margin or even an irregular scar-tissue formation. The radiations of scar tissue may be marked at one edge, while another edge of the ulcer is free

PLATE XXXV.

Photomicrograph of an acute gastric ulcer. *A*, The glandular layer or membrane showing the regular arrangement of a normal mucosa. *B*, Submucosa, much thickened, artery and veins. *C*, Muscular layer. *D*, Peritoneum. *E*, Edge of the ulcer showing partial destruction of the mucosa and a mass of granulative tissue below same. *F*, Part of the floor of the ulcer composed of disintegrating connective tissue. *G*, Mass of detritus that covers the pit of the ulcer to the other side. × 35½ diameters.

from them and soft and the ulcer margin abrupt. The gland cells at the edge of the ulcer (particularly in the cell nests of the fundus of the tubules) display cuboidal or cylindrical cells instead of the characteristic tubule elements. Such cells are also seen in the irregular crypts, vacuoles, or blind tubules that form in the scar tissue; these are considered by some observers to be neoplasmic in nature and the primary elements in the development of subsequent cancer. For some distance from the ulcer the lab-cells have the appearance of hyaline degeneration and their nuclei cannot be recognized by staining. The submucosa and sometimes the edge of the glandularis is permeated with small round-cell infiltration and a strong vascular net; these are most probably the beginning of repair process leading to cicatrization.

Healing of small ulcers may occur without visible cicatrization, although in ulcers of plainly visible size scar tissue replaces the area left by the necrosis. The healing process commences at the sides and floor of the ulcer, at which the margins become more indefinite and irregular in outline. In slowly healing ulcers patches of indolent granulation are common and chronic inflammatory areas which lead to erosion and recurrent bleeding may be present. Such erosions may involve surrounding new points in the glandularis causing opening of the large vessels with severe and even fatal hemorrhage. Scars vary much in size and thus subsequent contractions may deform the organ producing marked localized deformities, and when girdling, even an "hour-glass stomach" or giving a cucumber shape to the organ. They may also cause sacculation or a bridge-like formation, which, when situated in the pyloric region, may cause more or less stenosis with the development of stagnation of the food contents. If the necrosis is deep and rapid, the muscularis and peritoneum may be destroyed with perforation. This is particularly liable to occur when time enough has not existed or there is no contact of that part of the stomach to surrounding structures for protective adhesions to form.

The twelve different forms in which ulcered conditions of the stomach are met with, each of which is different from the well-known acute ulcer described, were offered by the author in a recent article under "The Recognition of Obscure Types of Gastric Ulcer" (Archives of Diagnosis, October, 1909), as follows:—

1. Small superficial and often multiple septic ulcerations of the pyloric region and duodenum. 2. Erosions or exfoliations, consisting of small flakes of the upper regions of the glandularis, conditions which have served as a cloak to the advancement of a newly discovered clinical entity, but which, nevertheless, were long before better

classed as "catarrh ulcers," and which are present mostly in chronic granular gastritis. 3. Fissures, generally of the pyloric region, and no doubt exceedingly uncommon. 4. Punctate ulcers, results of infection through the gastric tubule, a lymph follicle, or an acinous division of a mucous gland. 5. Small-sized peptic ulcers, single or multiple, gastric or duodenal or both at the same time, none of which pass through the inner stomach wall to the muscularis and thus all of which fail to give intense symptoms because the muscularis is not exposed to the gastric juice. 6. Ruptured varix from hepatic, cardiac or renal disease. 7. The chronic forms of ulcer, which begin as such, are usually single and most times gastric, ulcers which pathologically are excessive deposits of connective tissue at and infiltration of small round cells in and beyond the ulcer area. To these ulcerative states must be added the pathological types of a sequelous nature occurring in cicatrices from the more or less acute ulcers. In autopsies and operations are displayed: 8. The large, flat stellate, and the long, thick cicatrices causing deformities of the stomach. 9. Separation of the glandularis from the edge of a linear scar due to motion and marginal ulceration. 10. The autodigestion of the center of a thick scar by the gastric juice, caused by the center area of the contracting scar being almost devoid of circulation and therefore easily attacked. 11. Perigastric adhesions and broad extent of local interstitial connective-tissue deposit, causing hour-glass stomach, tugs on the contour of the stomach, or pyloric stenoses. 12. Malignant degeneration of an old ulcer.

SYMPTOMS.

The symptoms of gastric ulcer vary so generally both in character and intensity (some even presenting no definite or suspicious symptoms at all, or the first and only symptom being a serious or fatal hemorrhage or those due to perforation) that it is impossible to delineate special symptoms or symptoms in class as characteristic of any one of the varieties of ulcer conditions that may be met with. To show how impossible this would be, it may be said that depending upon the size, shape, depth, number and site of the ulcers, the character of the pathological process, complications and sequelæ, the age of the patient and the chemico-dynamic condition of the organ, the common clinical symptoms of pain, tenderness, gastralgia, vomiting, "dyspepsia," and the results from the gastric and fecal analysis vary markedly in each instance. However, in many of the cases of simple ulcer these are characteristic enough in grouping and intensity to make diagnosis possible, and these will be referred to as ulcers of the clinical

type. In the instances that depart from this (that is, those in which pain, hematemesis, vomiting, excess gastric juice secretion, gastralgia, etc., are masked or lacking) diagnosis requires most careful study and observation. And lastly, in the minority of cases it may be said that diagnosis is impossible by medical, and, in some instances, also by surgical means. As is proven by the many autopsy statistics, that the first discovery that ulcer of the stomach had or does exist is hardly less common than lesions of pulmonary tuberculosis or tuberculosis of the chest lymph-glands. According to Stoll, latent ulcer was found in 27 per cent. of 3476 autopsies, and Lebert reports that in 15 per cent. of 110 cases ulcer was present before severe symptoms arose manifesting its presence. When carefully searched for, small-sized depressed deposits of scar tissue from healed erosions are frequently met with at autopsy.

Not considering the plain clinical type of acute ulcer, Ewald[2] divides the symptom-complex of ulcus ventriculi into the following groups:—

"1. Cases in which the irritative symptoms which result from hemorrhagic erosion or the corrosion of larger or smaller areas of mucous membrane predominate, and there are no complications. 2. Cases in which the previously mentioned irritative symptoms and hemorrhage simultaneously appear. 3. Cases with symptoms of irritation and perforation. 4. Cases which run a latent course up to the time of death from hemorrhage or perforation. 5. Cases which present the sequelæ of ulcer. When we remember merely the fact that in these groups the symptoms may be variously combined, an ever-changing clinical picture is presented."

Pain.—The pain in gastric ulcer is one of the most prominent symptoms. It is variously described as burning, boring, cutting, tearing, or a constant dull ache. In each case the character of the pain changes usually according to the ingestion of foods or drink in the way that such may increase the severity or intensity of it. Therefore, over the course of hours it may be said to be paroxysmal—at one time dull, at another time excruciating. This symptom is produced by the irritating effects of the stomach contents on the exposed nerves of the ulcered surface, and also to the muscular contractions which arise in consequence of the irritation. They occur during the period of gastric digestion either immediately after the taking of food or after saturation of food with hydrochloric acid has taken place and excess free acid is present. As a rule (although there are many exceptions), the nearer to the pylorus the ulcer is situated, the longer after ingestion is the intensifying of the pains, which in many of those of the pylorus

and duodenum comes on three or four hours after the taking of food; this fact is of some value in diagnosing the seat of ulcer.

Early in the affection before marked gastralgia is present, the pain is localized in a small circumscribed area mostly in the pit of the stomach and near to the median line. At other times, it is near the costal edge on the left side. During the paroxysm the pain extend anteroposteriorly and may even radiate up the back and Vomiting and retching usually increase the pain. The distre usually made worse by the taking of coarse foods or irritating d and usually increases on pressure; although with some, a firm g pressure may afford some relief. Distention of the stomach with fluid or gas, and pylorospasm also increases their intensity. Too ingesta usually stimulate extra movement and secretion, and often increase the intensity of the pains or bring on acute paroxy If there be hyperacidity, the taking of highly albuminous foods fluid character (milk, eggs) often relieves the gastralgia. T anterior area of pain or point of tenderness on pressure is generally constantly present in the same place. In acute cases this area should be noted by proper marking and should not again be pressed upon during the course of the healing (irritation to the ulcer and danger hemorrhage). In subacute or older cases this precaution need not observed. The pressure to note the tender area should be made the tip of one finger and not be greater in force than for definite clusion.

Two spots of tenderness commonly exist in the cases of si ulcer of the clinical type, (1) epigastric and (2) dorsal. Consider the clinical types of ulcer, the epigastric pain occurs in about 90 cent. of all instances; both together in about 30 per cent.; the do alone in rare instances. Boas, who first drew attention to the indi pain, describes this as "localized and more circumscribed than epigastric, and generally located at the level of the tenth to the twel dorsal vertebra alongside of the vertebra in a lateral expansion of two or three centimeters and a length of one to four centimeters." This pain is usually elucidated on deep point pressure to the left of the spine and on a line with the spinous processes of the vertebræ. A like tender area may be noted to the right, in which case only the duodenum may be affected, or when the ulcer is in the stomach, the right and left sides are painful on pressure, but the left to a greater extent. In so far as the single objective symptom of spinal tenderness on pressure is concerned, we should not depend upon the presence of it to make a diagnosis or to conclude results of therapy. The largest proportion of cases of ulcer do not present them, and even if the healing

PLATE XXXVI.

A, Photograph of a clinic case of acute gastric ulcer showing the location of the direct pain (on pressure). It was found just below the ensiform and the area was about one inch in diameter.

B, Photograph of the same case showing the location of the reflex or indirect pain (on pressure). It was situated to the left of the spinous process of the twelfth dorsal vertebra.

C, Photograph of a private case of acute gastric ulcer showing the painful area lower down than above and to the left. (Miss L. K.)

D, Rear view of the same case showing the location of the indirect pain on the level with the ninth dorsal vertebra.

has been incomplete do not develop them subsequently. As a clinical sign their only value is as a suggestion to the diagnosis in the first or second examination—that is all. I have never been able to prove that these back pressure points were increased in intensity when the epigastric pain was marked. It has been assumed that they are referred to the posterior spinal nerves from some of the terminations of the corresponding anterior nerves that are involved in the ulceration. In my opinion, they are more probably due to a hyperalgesia imparted to the anterior branch close to the vertebral column by the sympathetic nerves from a lymphangitis about the celiac axis, or to adhesions or irritability of the peritoneum caused by the affected area (in this sense they may be considered as direct). My reasons for this contention are: 1. That the anterior branches of the intercostal nerves are not tender or sensitive to pressure in their course. 2. That pain, subjective and objective, corresponding to the area of distribution of the terminal fibers is practically never observed; the tenth supplies the skin at the umbilicus, the eleventh and twelfth the skin below this—does the pain exist or is there ever spasm only in the lower section of the abdomen? The first usually occurs in the epigastrium, and the upper rectus spasm is not constant and only takes place when pressure is made over the ulcer area. 3. That the degree of pain occurrence increases through the coats of the stomach from *nil* in the glandularis to intense in the peritoneum, and there most probably is no direct distribution of cerebrospinal nerves in the peritoneum. 4. That the pain is most probably referred by way of the communicating links from the great sympathetic plexuses (solar) which are intimately connected with the anterior branches of last dorsals at the back of the abdominal cavity; a clinical proof of this is the presence of the rather general longitudinal tenderness over the dorsal spine in the sensory gastric neuroses and gastralgia, and even in quite a number of cases of acute gastric ulcer. In my experience, the pressure pains at the back in ulcer may be met with at any vertebral level even as high as the sixth dorsal, although they are liable to be less common or they exist to a less degree as you ascend above the tenth or twelfth dorsal. These spinal areas of tenderness are more common in women than men. The local sensitive spinal areas in neurasthenia should not be mistaken for them.

Vomiting.—With few exceptions in so far as gastric disorders are concerned, vomiting is a symptom of importance in all serious stomach affections. Of course, like any other single symptom and even in the most severe gastric affections it may not be present or a marked feature in the history, but when it is, its occurrence should always

receive full consideration. In ulcer, statistics vary in the percentage of instances that it is met with; an average figure shows this symptom to be next in commonness to pain, being present in about 80 per cent. of a large number of cases. It usually occurs with pain, although vomiting, nausea and eructations may occur when no actual pain is present, or when only those of indefinite gastric distress exist (weight, fullness, pressure, dragging, etc.). Vomiting may be constant, occurring whenever foods or drink are taken, or it may take place only at intervals of several days or more. It may occur immediately following meals, or two or three hours afterward at the time when the mechanical or chemical irritation of the contents brings on ejection, and in these instances it is usually preceded by epigastric pain, which is relieved when the organ is sufficiently emptied. To some extent, the onset of vomiting depends also upon the quantity of food and does not occur when a small amount has been taken. In recent ulcers the food returns apparently as it was taken, but on close examination it will be seen to be more or less digested according to the status of gastric secretion and length of stay in the stomach. When pyloric stenosis is present the contents may display evidences of retention. The latter is not seen when only primary atony exists. The vomitus is usually very acid, and when occurring somewhat incessantly it may consist practically of gastric juice mixed with blood and mucus; at these times the quantity delivered at each vomiting spell is small.

Hematemesis.—Blood is frequently present in the vomitus, and occurs in plainly macroscopical amounts in about 30 per cent. of the cases, and when noted by means of blood tests of the gastric contents or feces in about 70 per cent. of all cases. It is well to recall that there are other causes of hematemesis (swallowed blood, gastric hemorrhage when no ulcerations can be noted, varix; congestions from cardiac, pulmonary, or hepatic disease; the blood dyscrasias, etc.). On the other hand, more general utilization of the blood tests (occult blood) in examining gastric contents and feces will show a greater percentage of bleeding from ulcers than would be noted from only the macroscopical observations. Especially is this true when ulcer cases are observed over an extended time and when complications and unfavorable sequelæ exist.

The blood is usually arterial, the vessel becoming eroded during the development of the ulcer, and may be serious and even fatal. In other instances the bleeding is more of an oozing from small vessels, is slight in amount, and may be observed as reddish-brown streaks in the vomitus, or only by the blood tests. When much hemorrhage exists, the vomitus is characteristic according to the amount of blood

and its degree of alteration. The feces at these times are deepened in color, reddish, or dark brown or black and with a shiny surface. Marked degrees of hemorrhage may also come from veins, or even the pore-like erosions referred to by Dieulafoy as "exulceratio simplex." Large amounts of blood in the stomach act like an emetic in the way of causing its ejection. In this event there may be no premonitory symptoms and the condition is not recognized until the vomiting occurs, after which the general symptoms of weakness, dizziness, rapid pulse, pallor, sighing, and demand for more air to breathe and water to drink develop (collapse more or less complete). If the quantity of blood be moderate or small in extent, neither the vomiting nor the general symptoms of hemorrhage may be observed. In these instances the blood passes into the intestines and may be observed by the examination of the feces, particularly by the chemical tests. The hemorrhage in acute ulcer is usually intermittent and large in amount, while that from the sequelæ and chronic ulcer is more constant and small in amount; still, in diagnosis, this is not a safe rule to follow, since acute ulcers may not have any appreciable hemorrhage and chronic ulcers a copious and repeated bleeding. In suspected ulcer it is always desirable to examine the stools for blood after the severe attacks of pain. Usually the younger the patient, the less the danger of death from bleeding, although in persons under thirty years the bleeding can be so large in amount or continuous that they are overwhelmed. Slight hemorrhages usually have no serious influence upon the condition of the patient. Moderate amounts lead to extreme anemia and its consequences. Death from hemorrhages is usually due to rupture of the ulcer, and corrosion of the splenic, gastric, or pancreatic artery or their veins, the portal vein, or the left coronary artery when the ulcer is situated in the lesser curvature near the cardia. Ulcer in any site of the stomach may cause fatal bleeding; those in the duodenum are not so liable to be the cause of profuse hemorrhage or hematemesis.

The noting of the presence of small amounts of blood (occult) in the gastric contents and feces is of value in the diagnostic, prognostic and therapeutic ways. In the diagnostic way, it usually means organic lesions of the gastric mucosa, and among these may be mentioned ulcer, erosions, cancer, hemorrhagic and phlegmonous gastritis, secondary gastritis from heart, lung, liver, and spleen disease, portal thrombosis, the infectious fevers, and amyloid degeneration of the gastro-intestinal vessels and organs. Some of the systemic conditions in which it may be found are hemophilia, purpura, arteriosclerosis and tabes with gastric crises. Blood may be present in the

feces in malignant and benign tumors of the gastro-intestinal tract; in the malignant and inflammatory conditions of the pancreas, liver, and gall-passages; in tubercular, syphilitic, or simple catarrhal ulcerations of the bowel, and the rectal conditions (hemorrhoids, fistula and fissure). The intermittent presence of occult hemorrhages suggests gastric or duodenal ulcer, whereas the constant presence is significant of carcinoma. In ulcer when treatment has been instituted it usually disappears; in cancer it is constant. In cancer the presence of blood is noted in the gastric contents in about 95 per cent. and in feces in about 80 per cent. of cases; in ulcer its presence is noted in the feces in about 30 per cent. of cases. In the uncomplicated neurotic or catarrhal condition of the stomach it is not found excepting from trauma from the stomach-tube—the feces examinations are always negative. During the cure of ulcer and afterward the subsidence and failure to obtain positive blood-test results in the gastric contents and feces are, in the absence of other symptoms, of good omen. If blood continues or recurs it usually means incomplete cure of the ulcer, complications or sequelæ, or carcinoma. Before making the tests for incorporated blood in feces, the lower bowel should be emptied by enema or otherwise, a small amount of carmine or charcoal given by mouth, following which all foods are allowed excepting those of meat and fresh fish (I do not agree with Martin that this extreme care is always unnecessary). By continuing the diet, and after the demarkation is noted in the stools, the feces is examined on the three successive days for blood, taking three portions of the feces in each instance (the lower end, the middle, and the soft end, or if the feces is mushy only one portion). The noting of the reaction at a single instance is a positive result; if it is not noted during the three days it is negative. In the diagnosis of ulcer the test is of value when positive, and does not argue strongly against ulcer when negative.

General Symptoms.—The general condition of the patient, as a rule, remains good, although anemia, weakness and emaciation due to local causes in the stomach are common and sometimes marked. The symptoms of pyrosis and regurgitation of acid fluid and gas from the stomach are usually present in the latent cases. The appetite remains good, but the patients fear to eat because of the pain. In the complications and chronic ulcer there may be distinct anorexia. Nervousness ensues from the constant pain and subnutrition. Absence of fever is the rule, but a rise of about 1° F. may exist particularly when peritonitis, adhesions, perigastritis, or hemorrhage exist. Thirst is common, and constipation is the rule.

The blood usually shows a decreased red blood-cell and hemo-

globin content and a slight hyperleucocytosis; particularly is this true after hemorrhage has occurred. The blood changes are those of a secondary anemia, and should be considered both as a result and cause of ulcer. Still, as was mentioned before, in the healing of the ulcer specific attention to the anemia is often necessary for the healing of the lesion.

When vomiting or profuse bleeding occurs the urine is lessened in quantity. Its acidity is usually lower than normal, and may even be neutral. In chronic ulcer when gastric stagnation exists the urine may contain a high ethereal sulphate partition and indican. The albumoses may be present, and albumin is a common finding in ulcer of middle life or the aged.

Objective Signs.—The front and back tenderness has been mentioned. A general tenderness over the stomach region in the abdomen may be present, particularly when marked gastralgia exists. A sharply localized tender area at or near the median line (left or right) is suggestive of the site of ulcer being in the pyloric region; if distinctly to the right and there is no diffuse tenderness over other stomach areas and the back pains are absent or at the right of the vertebra, it suggests ulcer of the duodenum. In so far as the stomach proper is concerned, too much dependence as to the site of the ulcer must not be placed on the location of the tender area (unless this is confirmed by the X-ray); in diagnosing duodenal ulcers the latter is of no value. Point tenderness more to the right and higher (biliary area) is more suggestive of gall-bladder affections. No tumor is palpable in fresh ulcer, but a small one may be formed and be palpable after scarring. In recent ulcers the degree of tenderness is often so great that resisting spasm of the upper recti is observed during the course of examination.

Gastric Analysis.—Quite naturally this varies according to the type of ulcer, and the site, extent and condition of sequelæ. In the clinical type of acute ulcer when the characteristic symptoms of acute onset of pain, vomiting and hematemesis are present, gastric analyses are not necessary for diagnosis; the clinical observance of the patient and a test of the vomitus for acidity and blood are usually all that are required. When the symptoms are not pronounced and particularly if there is a suspicion of ulcer being present, the stomach-tube should be used for diagnostic purposes. For many years (because of the danger of perforation by the tube or from the straining and retching its passage causes) the controversy has waged as to whether a tube should ever be passed in distinct ulcer cases or even in the suspicious ones. Personally, I fully agree with Ewald that it should, and that no danger can come if sufficient care is taken and it is manipulated by

experienced hands. Logically, some modifications to the usual procedure of extracting test-meals in the way of obviating prolonged straining should be observed, and for this reason the aspiration method is distinctly preferable to that of simple extraction. In obtaining the stomach contents quickly and in sufficient amounts for complete analysis, the author's test-meal bottle method is particularly to be recommended, since by its use a steady and gentle draw to raise the stomach contents is safely and quickly accomplished (page 142). In these cases one should always be satisfied to obtain between 20 and 40 cubic centimeters of contents, since those amounts are usually enough for the performing of the chemical, quantitative and qualitative tests and get a fair idea of the motility of the organ. Of course, this manipulation is not to be undertaken during or immediately after a profuse hemorrhage, and it is often of additional safety to do the extraction with the patient in the prone position and on the left side. The tube should not be introduced too far, but just to the level that the return begins, which, in the left-sided prone position, is when the tip of the tube is in the fundic end and before it has coursed a length of the greater curvature. Particularly are these examinations called for in instances of the so-called latent ulcer, in the presence of complications (excepting profuse hemorrhage and perforation), and the sequelæ.

The objective point for diagnosis is the presence of incorporated blood in the test-meal noted in many cases of ulcer in which vomiting, hematemesis, or distinct pain is absent, and not primarily the status of gastric-juice secretion. In the absence of macroscopic evidences of blood the chemical tests for its presence should always be performed; the latter are more to be depended upon than the use of the microscope or spectroscope, although the latter means are conclusive when positive, which is not as often as the chemical tests.

In the event of the stomach being emptied by the extraction, the usual findings are a low amount of return (due to the hypermotility that generally exists with acute ulcer), and a high acidity to the contents. Too much dependence, however, should not be placed upon an absence of these findings because acute ulcer cases are encountered in which the return is high and the acidity low or absent. It depends mostly upon the condition of motility as to the combination seen. With a low return and hyperacidity (hypermotility) the findings pair in significance with a high return and a low acidity (hypomotility from primary atony or that due to obstruction). For manifestly the same amount of gastric-juice secretion may exist in both instances excepting that the degree of dilutions of it is different.

When diagnosing the existence of ulcer the degree of acidity is of

less significance in the suggestive way than that of a history or a diagnosis of the existence of a hyperacidity prior to its occurrence. The controversy still wages on hyperacidity being a symptom of ulcer. In my opinion, it is only so in the causative way above expressed, and is of no value in that of an ulcer causing irritation to the stomach mucosa and thus a higher status of gastric-juice secretion. In ulcer, I believe that should the gastric juice show a high acid content in a measured quantity this is brought about by the irritation of the muscular base of the ulcer causing a general hypermotility; and this means condensation of the acid secretions (possibly inflammation of the peritoneum, fresh adhesions, etc., could also bring about the same result). And thus, because only in the minority of acute ulcers is the muscularis freely exposed and the above-mentioned complications not met with, no strong dependence should be placed upon the symptom. For if there was, considering that states of excess gastric-juice secretions are so common (hyperchlorhydria, gastrosuccorrhea), why is it that a normal acidity is met with in 56.8 per cent. of gastric ulcers and a subacidity in 9 per cent.? (Ewald's figures taken). Köhler's statistics are even more significant in this direction, although it is probable that the figures of this observer included cases of carcinomatous degeneration. Therefore it is that we must not be guided in utilizing these chemical findings. A hypersecretion may exist without ulcer being present, and a simple ulcer itself cannot stimulate a higher secretion. There is, however, more clinical importance in the connection that in ulcer a continued sub- or an-acidity with lactic acid and blood should make one consider the presence of malignancy.

Particularly in the difficult to diagnose cases of gastric ulcer (latent) much valuable information may be gained from the fermentation of neutralized test-meals. In simple hyperacidities the bacterial content is low and the gas results are usually *nil* (always under 2 per cent.). In ulcer, even in the face of condensation of the normal acid, this result is often increased and may run as high as 27 per cent. This is due to the bacterial increase that usually accompanies gastric ulcer. In the presence of sufficient acid, I look upon 2 per cent. of gas and over as suspicious, and this, in my opinion, forms the most practical clinical method of diagnosis we have for these difficult to recognize, numerous and most important to be aware of conditions. In twenty-seven instances of the plainly clinical type of ulcer I found a gas result present in all, the gas content ranging from 2 to 27 per cent., with 7 per cent. as the mean average in many examinations. Instances in which there are no suggestive symptoms of ulcer and the ordinary methods of gastric analysis led strongly to the diagnosis of

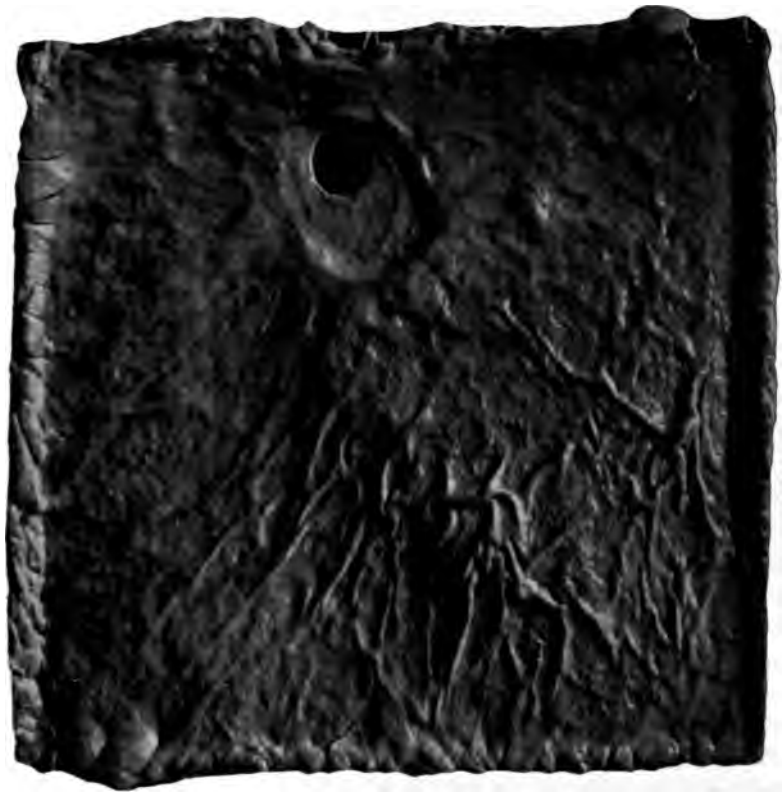
persistent hyperchlorhydria or gastrosuccorrhea, a gas content of 2 per cent. or over adds the suspicion of a recent or old ulcer being present.

Soupault operated upon twenty-eight cases of typical gastrosuccorrhea and in each instance found an ulcer at the pylorus. In forty-eight cases of gastrosuccorrhea Mathiew and Taboulais found hematemesis or melena six times, and eleven times very severe pains were referred to spasm of the pylorus. I agree fully with Ewald that gastrosuccorrhea, or hypersecretion, formerly regarded as a true neurosis, is not always to be regarded as a consequence of ulcer running a latent course. In separating the simple dietetic from the ulcer cases it much depends upon the number of analyses of gastric contents in each patient that are made in the way of noting—Is it a gastrosuccorrhea that improves sufficiently under therapy, or does it continue in spite of medical measures? The great majority of those that continue an excess secretion are ulcer cases and are surgical in nature. and as was stated before, in diagnosing these the amount of gas product is the most valuable single measure of clinical diagnosis we have.

In hypoacidity and hypomotility when the volatile acids are a prominent feature in the test-meals (chronic gastritis), in the low infective states, in the acute inflammatory conditions, and occasionally in the sensory forms of gastric neuroses, the gas content is sometimes over 2 per cent., but in these the hydrochloric acid content is low and that is the distinguishing feature in separating them from ulcer and instances of pyloric stenoses. In primary malignant disease this low or absence of HCl with the presence of other findings (lactic acid. Boas-Oppler bacilli, more constant blood), and because of the carbohydrate fermentation and proteid decomposition from stagnation, the gas content is the highest, usually over 10 per cent. and found in one of my cases to be 56 per cent. I firmly believe that when more attention is paid to the matter of gas results, more than one ulcer case out of four or five can be diagnosed by medical means. The Ewald simple test-meals, or the fluid vomitus from cases that have uncontrollable vomiting are used in the estimations; the test-meals which remained the usual length of time in the stomach before extraction answer the best for diagnosis. The ordinary fermentation tube apparatus may be used, although the author's form answers best for the observations. The description of the technique of these examinations will be found in Chapter VII, page 188, and Chapter VIII, page 250.

Perforation.—Perforation with copious hemorrhage comprises the most serious complication of ulcer. It occurs early or late in about

PLATE XXXVII.



Acute perforating ulcer. At the margin the ulcer presents the typical round punched out appearance of an acute ulcer. Beyond the ulcer is seen an irregular formation of inflammatory thickening due to infiltration in the glandularis and a little exudate in the submucosa. This is no doubt the beginning of repair scar tissue formation, and it is seen surrounding most acute ulcers after they had existed for some days. Otherwise the stomach presented quite a normal appearance, excepting that in places here and there were areas denuded of columnar cells.

ing pylephlebitis. The gall-bladder or gall-ducts may be involved (the illustration of duodenal ulcer displays a free opening into the cavity of the gall-bladder), with evidence of a septic cholecystitis or obstruction of the ducts. A left-sided cellulitis may occur, with involvement of the spleen (perisplenitis) or left kidney region. Again, the intestines may be entered, more or less directly, with the formation of fistulæ (Murchison found ten instances of gastrocolic fistula in thirty-three perforations due to ulcer). In the latter instance there may be severe diarrhea and bloody or purulent feces or fecal vomiting. When the pelvis of the kidney is entered there usually is

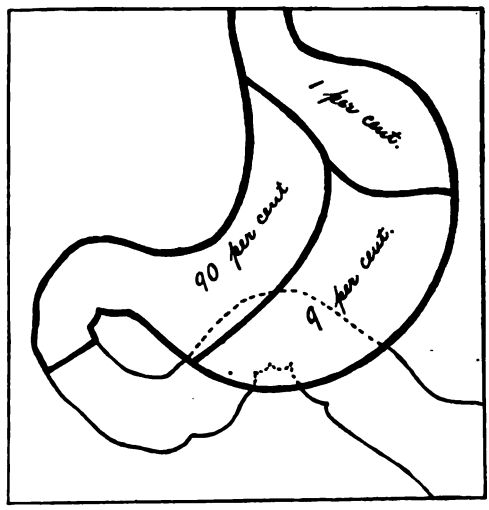


Fig. 90.—Showing the location of gastric ulcers as noted in cases of perforation. The lines include both sides of the stomach viewing the organ as a whole from the curvatures.

pus in the urine. In rare instances the adjacent viscera may escape infection and the abdominal wall be involved with the production of an external fistula. In favorable cases, when the ulcer ruptures into the abdominal cavity between the stomach and the closely lying intestinal coils, the walls of the intestine, with the resulting adhesions, and the omentum form a cavity and thus ensacculate the infection for the time being with subsequent general involvement, or permanently with immediate recovery resulting in severe adhesions. When the infections are thus localized, a chronic course may ensue, and, by dissection and pointing, the exit of drain be in the pelvis of the kidney, colon, vagina, or any part of the intestinal canal or external abdominal

Perforation into the free peritoneal cavity is by far the most frequent, and happens after adhesions or abscess have formed or without these. Those in the anterior wall set up a general peritonitis more commonly and quicker than do ulcers of the duodenum and those elsewhere in the stomach. As was stated before, the reasons for this are because the anterior wall is not protected by adjacent organs (thus the perforations open directly into the large vertical peritoneal sac), and that the stomach contents are more infective in nature than is the chyme after it has entered the duodenum, which latter is tightly moored in its upper part to the bodies of the vertebra, is comparatively small in size, deeply set, and more protected by adjacent structures.

According to the clinical course, Moynihan has classified the cases of perforation into acute, subacute and chronic.

In the acute cases, the onset is sudden, a free entrance into the peritoneal cavity takes place and the symptoms are severe and general from the beginning.

The subacute cases are those in which the onset is not so sudden or severe. These occur when the opening is small in size, the stomach at the time empty of food, localizing adhesions have occurred, or the omentum blocks the distribution. These are the instances in which localized peritonitis or abscess formation have first occurred, after which the inflammation becomes more general. Such instances are liable to give the symptoms of increased pain rather sharply localized, a moderate fever, and suggestive white blood-cell count. Among these cases are those of the anterior wall perforation in which the onset of a general peritonitis is held back for a short time by the transverse colon and mesocolon acting as a barrier to infection to the lower part of the great peritoneal cavity.

The chronic cases are those in which protective adhesions have first been formed, and the symptoms are ephemeral or those of abscess. A localized peritonitis may last for some time which may become general. Extensive adhesions in the abdomen are common, especially with the liver, pancreas, colon, small intestine and omentum. The peritonitis and abscess are located in the upper abdomen and may be between the coils of the intestine, or be posterior and the lesser peritoneal cavity involved, the infection from which subsequently breaks through the foramen of Winslow and becomes general.

Lastly, may be mentioned the fact that in a minority of instances of ulcer, perforation may occur very late. Among the conditions of more or less healed ulcer in which such can ensue may be mentioned autodigestion of the central areas of a long-standing scar, the gradual attrition of some of the soft forms of latent or chronic ulcers,

marginal erosions and ulcerations at the edge of an old scar, and perforation occurring during the course of malignant degeneration. The latter are rare because of the extent of perigastric adhesions and connective-tissue deposit generally present in malignant degeneration.

The symptoms and signs of perforation vary according to the conditions present. It may be said that there are no pathognomonic symptoms of perforation, although the severe acute cases are often easy enough to diagnose. In these the onset is usually sudden, and the pain and tenderness spontaneous and referred to the site of perforation. In a short time the pain spreads across the upper abdominal area, although its original site is usually at the center of greatest tenderness. Deep breathing causes pain, and the case may be mistaken for a pleurisy particularly of the diaphragmatic type. At first the abdomen is flat, tense and immobile, and patients assume the position that gives the most ease and complain upon being moved into another position. Later on the abdomen distends but still remains rigid and immobile. This latter combination is most significant, for in intestinal distentions due to other causes (such as is seen in severe septic pneumonia) the abdomen is tense but still soft (balloon like). The movements which affect the viscera of the upper abdomen (breathing, coughing, vomiting, retching, etc.) increase the pain, while those which affect the lower part (micturition) are not so painful or cause no pain at all. The liver dullness is absent in one-quarter of the cases, diminished in one-half, and not affected in the other quarter (this depends upon whether general peritonitis is present and to what extent). A friction rub may be heard over the diaphragm and the gurgling of fluid through the perforation are symptoms possible to obtain in a few cases. Because of the rigidity of the abdominal muscles, percussion of the stomach area in the way of noting diminution of the size of the organ is not possible, nor is it advisable. Collapse and prostration soon supervene. The pulse is usually accelerated, but may be as low as thirty to the minute in the early instance; for a short time early in the case it may be normal. The temperature is not altered at first, but soon raises or becomes subnormal depending upon the rapidity and extent of collapse; as a rule the rise in temperature is not higher than 39° C. (102° F.). The slower the onset of symptoms of general peritonitis the higher is the temperature run; therefore, the noting of the temperature is not important and may even be most confusing in early diagnosis (this excepts the subnormal temperature from collapse). The face is usually drawn and pale, the angles of the mouth depressed, and the expression anxious. At the close of the case, the examination usually displays marked general distention of the abdomen, oblitera-

tion of liver dullness, vomiting, singultus, cold skin, facies hippocratica, small running pulse, unconsciousness and Cheyne-Stokes respiration, after which the patient succumbs. Such is the observation of many of the neglected acute perforation cases.

There are others, however, in which the onset of severe symptoms is less distinctive. Quite naturally, when one has an ulcer case under charge (before perforation), the routine medical observances in the way of changes in the character of the pulse, intensification of the pains, the onset of abdominal muscle rigidity, rise in temperature, onset of a rising hyperleucocytosis, etc., should make one suspicious of this complication, and when these symptoms develop directly and in sequence the transferring of the case to a surgeon is usually justified. It is in the subacute cases that the internist is very liable to delay until too late, and the main cause of this in my experience is due to the belief that the early symptoms observed are those caused by perigastritis or lymphangitis from the ulcer, and not primarily to perforation. It is here that the internist shoulders a great responsibility, and one which requires his closest attention and analysis. A blood count should immediately be made, followed by successive counts every few hours depending upon the character of the case. If the leucocytes keep steadily rising in numbers (whatever figure they begin with), and the neutrophiles relatively increase and perhaps the eosinophiles coincidently diminish or become absent, our duty to the patient is to insist upon immediate surgical intervention. We may be mistaken in the advice, but this is a matter in which a dozen mistakes is no argument against the one that may be otherwise. We can hesitate in the matter of surgical intervention for hemorrhage (even copious) but not in the presence of only a good suspicion of perforation.

Other cases again develop the symptoms of perforation as the first symptom of ulcer. These may be in individuals who have had more or less prior gastric disturbance and they may be in those who had not. In these a sudden pain in the abdomen, usually after a strain such as in vomiting, defecation, bodily exercise, a heavy meal, trauma, etc., and which pain is followed by the above enumerated symptoms, should put one on guard of the possibility of perforation.

Cases of pseudoperforation have been reported but they have been very few, and do not justify a hesitancy of surgery in the light of the great advances that upper abdominal surgery has made in recent years and the doubts that surround many of these cases from the internist's side. When the patient is young and the surgeon experienced, the element of danger is small. It was no discredit to Manges to have had a young woman operated upon who had previous signs of ulcer

and suddenly developed pain and tenderness in the epigastrium with rigidity and a temperature of 102° and a pulse rate between 120 to 140, even if no perforation or peritonitis was found at operation. That was one case; the next hundred would be cases of perforation in which the course and results would be justified.

In cases in which the perforation leads into the lesser peritoneal cavity, or through the diaphragm and into those of the chest or heart, the symptoms may be modified in these directions. In gastric ulcer, the respiration must be recorded regularly, and whenever these rise perceptibly the chest should be examined for fluid or gas in the pleura. The onset of chills and a septic temperature should draw attention to such conditions as hepatic, subphrenic or mediastinal abscess, or septic conditions in the lung, pleura, or general body.

SPECIAL CONSIDERATION OF DUODENAL ULCER.

As is noted in autopsies, simple ulcers of the duodenum are somewhat less frequent than those of the stomach (in about the proportion of 1 to 10); although from a surgical standpoint they may be encountered in more equal proportions, Mayo recently reporting 98 duodenal ulcers to 87 gastric. Like gastric ulcers, most of the cases are met with in those in the second and third decades of life, although no age is exempt. According to the sex statistics from the best sources, there is a reversal in duodenal ulcers as compared to the gastric—duodenal ulcers occurring more times in men than in women in about the proportion of 4 to 1. Considering the number of cases in the four portions of the duodenum, it can truthfully be said that the nearer to the pylorus the greater is the percentage. Practically all of those in the first portion extend to within three-quarters of an inch of the pyloric sphincter, and the deepest portion of the ulcer is just outside of the pylorus where the acid chyme mostly affects the intestinal mucosa. As regards site, of 454 cases Martin[3] gives this as 91 per cent. in the first portion, 7 per cent. in the second portion, and only 2 per cent. in the third and fourth portions. They may occur single (50 per cent.), double (20 per cent.), or be more than two, and may occur in the duodenum alone, or may be present here and in the stomach at the same time.

From a clinical standpoint what has been stated regarding gastric ulcer is also true of the duodenal. The clinical and surgical features of gastric and duodenal ulcers are so closely allied that a consideration of gastric ulcers cannot be separated from the duodenal. This is made still more so by the fact that at the times of perforation this is often

PLATE XXXVIII.

Duodenal ulcer in the posterior wall, and perforating. Site of ulcer just above ifice of bile and pancreatic duct. Gall bladder above and to the left, and which ntained a single large, round stone weighing 6.8 grammes.

so close to the junction of these two organs that the perforation could be referred with equal frequency to either one or the other viscus according to the judgment of each operator. Regarding the special clinical features of duodenal ulcers as compared to those of the gastric, there is hardly much more to be said than what is already included in the symptomatology of the latter.

Among the special clinical points in differentiating ulcers of the two sites may be mentioned firstly the pain. In my experience, this is apt to be not so acute as in gastric ulcer and more burning and boring in character. It is present in about 80 per cent. of all cases, and it is commonly located in the midline or slightly to the right. In other cases, however, it is most acute and excruciating, and may even be complained of close to the right costal margin, but rarely out or down as far as the location of the gall-bladder (under the tip of ninth right costal cartilage). Remissions of pain are often a distinctive feature, and when present the paroxysms are usually observed from two to four hours after ingestion, when the ulcer site has been mechanically and chemically irritated by the acidulous food. Pain which is instantly relieved with the alkalies suggests gastric origin, and when not until later (three hours) suggests, when other symptoms are present, that the ulcer is in the duodenum. The special tenderness may be confined to the right side of the spine, although this is an uncommon symptom and not to be depended upon in diagnosis even when present.

Vomiting is not so common as in the gastric form, and may even be absent altogether. When it occurs admixture with blood is not so often seen, or the blood occurs only when vomiting has taken place late after ingestion and before all of the food has left the stomach. At these times it is usually due to regurgitation of blood through the pylorus, which can only occur when most of the food has left the stomach and the pyloric closure is not so constant; still, it must not be forgotten that even vomiting of blood late after meals is seen in gastric ulcer. Naturally, if bile is present with the blood one would be inclined to feel that regurgitation had taken place and that the site of the ulcer was beyond the pylorus. Altogether, vomiting is less common than pain. The return is more frequently acid and occurs usually when food is in the stomach.

Hemorrhage.—A copious hemorrhage into the stomach may occur with ejection, or the same may take place into the bowel with melena. A case which presents the chemical picture of ulcer in which the test-meal analysis does not display blood and the feces examination does is very liable to be one of the duodenal type. Incorporated blood in the stool is always suspicious of ulcer high in the intestine. Melena is

at some time found in about one-half of the instances of duodenal ulcer and is a most important symptom of this affection. Blood may be present in the stools when the common clinical symptoms of ulcer are absent or too indefinite for diagnosis. When the bleeding is constant, the secondary symptoms of anemia (pallor, reactionary fever, weakness, loss of weight, etc.) are generally present. A case of mine that was operated upon recently, presented a constant occurrence of large amounts of blood in the stools and no symptoms other than the anemia and loss of weight. This case was in an alcoholic, a history which in my experience is commonly obtained in duodenal and ulcer of stomach of the perforative type.

Jaundice has frequently been observed from obstruction of the common bile-duct from catarrhal inflammation, or the coincident presence of ulcer with cholelithiasis—a not uncommon combination. Therefore, when the symptoms resemble biliary colic, especially the character and seat of pain and tenderness, and an intermittent jaundice is present, the differential diagnosis may be most difficult. The appetite is usually good in ulcer but when pain exists there is fear of eating to satiety both in quantity and quality of foods; thus the subnutrition and loss in weight. It has been a clinical observation of mine that in uncomplicated gall-stone cases the appetite is generally good and the patients eat well of all necessary foods and in quantities large enough to maintain good nutrition; this is a clinical distinction that has helped me in separating some of these two types of cases. Distinct gastralgia of the stomach is not as common in duodenal ulcer as it is in the gastric form.

Perforation with serious consequences are liable to occur. Most of these are found in the anterior or unprotected wall of the viscus and by far the largest proportion are near the pylorus. Exceptionally the posterior wall is involved. Those in the second part on the anterior surface lead directly into the general peritoneal cavity, while perforations on the posterior surface are, for obvious reasons, extraperitoneal. Perforations in the third and remaining portion of the duodenum are exceedingly rare.

The rapidity with which the resulting peritonitis develops varies according to the size of the perforation, the amount and condition of the escaped contents, and the ease with which this can pass to the more remote parts of the abdomen. The more infectious and acid the material, the greater is the intensity of peritoneal infection. It is for these reasons, and because the duodenum is tightly attached to the spine and overlayed with motile viscus, that the perforations of duodenal ulcer are more infectious and dangerous, and the results from

operation not as good as they are in those of gastric ulcer. Still, one is quite as fatal as the other, and life is rarely saved unless the patient is operated upon within the first twenty-four or thirty-six hours. For obvious anatomical reasons, perforations of the posterior wall are liable to have the infection localized for a time.

DIAGNOSIS OF GASTRIC AND DUODENAL ULCER.

When the classical symptoms are present (which is about one in four cases) diagnosis is easy. In a rough way it may be said that by the closest attention and study in each instance, about two out of the remaining three cases can be diagnosed, and that in making these matters of special technique and the laboratory offer the most substantial aids (these include the cases of erosions and hemorrhagic conditions of the stomach, which in practice must be included as ulcered conditions and in which the diagnosis is rather accidentally stumbled upon or, on the other hand, made only after a length of careful observation). In the remaining one out of four cases diagnosis is impossible unless complications or sequelæ develop. As a rule the diagnosis of the seat of the ulcer is impossible in definite ways, and it may be said is not important from either the medical or surgical standpoint. However, some of the recently advanced ways of arriving at this may be tried, and the most important of these are the following:—

Bönniger[4] has reported two methods of investigation that may be of service. The first is the increasing of the pain of the ulcer by the introduction of acid into the stomach. The procedure he employs begins with the passage of the stomach-tube in the morning before food is taken. If no contents are obtained, 100 cubic centimeters of water are poured in, and after slight movements on the part of the patient this is allowed to flow out. Through this procedure the pain of ulcer should not be increased. After the removal of this water, 100 to 200 cubic centimeters of decinormal hydrochloric acid solution is poured into the stomach through the tube. If ulcer is present sharp pains immediately appear, which can be dispelled by the administration of milk. According to Bönniger, if after these procedures there are no manifestations of pain it is safe to say that no ulcer is present. It is logical that a necessary condition to the application of this test is that the stomach be empty, and, as the object is to increase the characteristic pain, pain must be present in the case in the first instance. I have tried the test as above described in seven cases of the clinical type of ulcer; in four of these the pain was claimed to have been increased, although in none of them was I able to observe by change in the patient's attitude, expression, etc., that this was so. It may be

that these were not ideal cases for the test because in each instance there was a return of acid fluid from the morning stomach before the water instillation (which is usual in gastric ulcer cases), and thus the slight difference in the acid content before and after the acid instillation was not enough to observe a difference in the pain. Then again, as retching and straining usually intensify the pain in ulcer cases and as these are commonly brought on by the passage of the tube, it was difficult to say whether the increase or institution of pain was due to the decinormal hydrochloric acid solution or only to the straining from the tube or to both together. Of the remaining three cases one was a case of erosions with hyperacidity in which no change was noted even when the hydrochloric acid solution was drunk some time after the stomach had been washed out. The other two were typical acute ulcer cases, one with a normal secretion and the other with a distinct and continuous subacidity. In the first of these no intensification of the pain was observed, and the second claimed to have less pain after the procedure than was present before. In the light of these much too few observations, and because of my hesitancy to use the tube when the presence of an ulcer is only suspected and unless there are definite indications for its use during the course of treatment, I have modified the use of this procedure (no tube being used) in the following way: In the morning after a dose of Carlsbad salts in tepid water and when the bowels have moved, I give an Ewald meal. If at the height of its gastric digestion (one hour) the pains are not intensified, I give about 2 cubic centimeters of dilute hydrochloric acid in half a glass of water. Should this markedly intensify or bring on a paroxysm of pain I feel that I have another suspicious symptom of ulcer (not a positive one), and if it does not, I still do not exclude the possibility of ulcer.

The second method of diagnosis that Bönniger has found is by means of the Roentgen rays in the way of noting how accurately a painful point corresponds with any particular area of the stomach. This method, which I confess I first looked upon as a diagnostic curiosity, has been the means of some surprisingly accurate diagnoses in my hands. Of course, the ulcer must be large and deep enough or have adhesions drawing upon it to receive sufficient bismuth to give an irregular line to the contour of the stomach and the ulcer must be situated at or near one of the curvatures to observe this (ulcers of that size are usually diagnosed easily enough without resorting to the procedure). But when pain, vomiting, hematemesis, intolerant stomach, etc., are not distinctive enough in the case, and when the persistency of the gastric distress and the suggestions from gastric and feces

analysis are present the method should be tried, because, even if an ulcer be present and it could not be observed, still much useful information as to the shape, size, position of the organ is obtained and thus the possibilities of the diagnoses of perigastritis or perigastric adhesions. A most efficient X-ray apparatus is required, a large coil or a transformer, abundant current, and a silver or heavy anode tube are essential. The exposure must be quick and made between respirations, because the detail for diagnosis covers only a small area on the plate and it must be definite for positive conclusions. The skiagraph is made as follows: The site of the tender area is accurately noted and this location is confirmed with the patient lying flat on the abdomen. This is then marked with a small lead cross or P to represent pain, and a coin is placed at the umbilicus and another at the ensiform. The bismuth mixture is then given in the sitting or standing position, immediately after which the exposure is made with the plate under the abdomen and the patient lying with the abdomen down. The tube is at the rear and diaphragmed and the rays directly traverse the body from the back to the front so that the pyloric region is distinctly outlined. An irregularity of the stomach corresponding to the cross or P strongly suggests the presence of ulcer at that site. When the skiagraph has been properly taken, a negative result does not exclude ulcer, because such may be in the anterior or posterior wall of the stomach or duodenum and not be shown in the plate.

Einhorn[5] has advanced a method which consists in the swallowing of a "duodenal bucket" attached to a long silk thread. The bucket is swallowed in the evening and is removed in the morning before breakfast. According to this author, if an ulcer is present a brown or dirty black discoloration is found on the string, and by measuring the distance of the discoloration from the teeth the site of the ulcer can be approximately determined. (Some years ago I employed with satisfying results in cases of esophageal disease in which there were suspicions of ulcer or cancer of the gullet, a length of No. 15 surgeon's braided silk with an ordinary shoe-button tied to the end. The length of string was proportionate to the height of the individual and was measured by holding the button at the level of the spinous process of the tenth dorsal vertebra, from whence the string was passed up to the nape of the neck, and then loosely over the ear and forward to the lips. At a point about 10 centimeters beyond this a knot was tied in the string, and the shoe-button and all of the string to the knot was swallowed and left in over night; the outer end being fastened with adhesive plaster to the cheek beyond the angle. The string was slowly withdrawn in the morning and observed as in the Einhorn

method. I see no special reason why a more expensive and more difficult to procure apparatus need be employed for ulcers situated lower down. Of course, the string would have to be longer for pyloric or duodenal ulcers, and an extra amount equal to between 25 to 38 centimeters (10 to 15 inches) beyond the tenth dorsal vertebra and lip length would be sufficient; the extra length would depend upon the shape of the stomach, for in marked degrees of prolapse it would have to be longer). This method is not of value in ulcers of the fundus and greater curvature of the stomach. For the localization of these Einhorn has devised a bag covered with gauze, which is introduced into the stomach in the collapsed condition and is then inflated. At the end of half an hour the bag is allowed to collapse and is withdrawn. According to this author, if ulcers are present, brownish areas will be noted on the gauze corresponding to the site of ulcer. The latter method is only applicable to patients who are accustomed to the use of the stomach tube. Personally, I have had no experience with the latter method.

In the differential diagnosis between ulcer conditions and others may be mentioned particularly gastralgia, hyperesthesia, cancer, hyperchlorhydria and gastrosuccorrhea, hemorrhagic and other forms of gastritis, particularly gastritis acida, pylorospasm, appendicitis, pregnancy with hyperemesis, the various conditions in which blood may be swallowed or gain entrance into the stomach, uremia, biliary and kidney stones, arteriosclerosis, spinal disease and others. A distinction must also be made between the various types of post-ulcer conditions, and these will be offered under the separate heading which follows.

Gastralgia.—In gastralgia the pain is rather independent of the ingestion of foods and of their amounts and character and may even be stopped by the taking of them. The pain is usually burning and relieved by pressure or the application of heat. A cold sensation in the stomach may exist. There may be pressure points over the intestinal plexuses. If there be vomiting this is not liable to be much of a feature, stops in a few days, and the vomiting does not relieve the pain. The appetite is irregular and capricious, there is much eructation of odorless and tasteless gas, and salivation may exist with a constant necessity of swallowing. The chemism of the stomach is not especially altered, and the return does not contain blood, bile or lactic acid. Bacteriological examinations are indifferent. No fever is present, and the skin may be of normal turgescence but perhaps pale when the distress is acute. Hysterical symptoms are common, and the symptoms of general distress may be out of all proportion to the degree of pain.

The physical examination does not display a definite area of sharp pain but a more diffuse tenderness on pressure, which, however, may be most complained of in the epigastrium. No symptoms of perforation are present, and epigastric pulsation may be observed. During the attack constipation is the rule, and afterward the passages may be fluid containing much mucus but no blood. The condition subsides in a short time, possibly without much if any treatment, and the distress soon abates entirely. A mild degree of hyperesthesia may persist for some time which generally subsides with the administration of the bromides. In simple hyperesthesia none of the acute symptoms exist, the symptoms practically are altogether subjective, and the patients are about and respond quickly to proper medical treatment.

Cancer.—In this affection debility and emaciation often precede the other signs. The pain is more constant, less in degree, more independent of food, and often nocturnal. Anorexia is frequent, the taste pappy or insipid, and aversion to meats commonly exists. The appetite improves with lavage. Fetid eructations are frequent. Digestion is insufficient, stagnation of foods common, and the chemism in late cases shows the absence of hydrochloric acid and the presence of blood, Boas-Oppler bacilli, lactic acid and pieces of cancer tissue. Vomiting is common and gives less relief than in ulcer. Collective vomiting may be present. The hematemesis is often of the "coffee grounds" character; in ulcer, the blood is usually of a bright color. Epigastric pulsation occurs only with marked emaciation. A low degree of fever is common at the termination of life. Cachexia is marked, the skin being sallow, yellowish, brown, dry, or flaccid. Melancholia and indifference to things in life common. Patients are usually between the fortieth and sixtieth years of life. Tumor of varying size and shape distinctly palpable in the epigastrium. Involvement of the left lobe of the liver common, as well as other metastases. Perforation only after long illness, and when occurring into the colon lientery may be present.

Hyperchlorhydria and Gastrosuccorrhea.—Distinct pain and tenderness not present. Vomiting is rare and usually occurs after some indiscretion in diet. Epigastric distress is most marked from one to three hours after meals (hyperchlorhydria), or in the early morning when the stomach is empty of food and there is gastric juice in the organ (gastrosuccorrhea). The laboratory findings are usually suggestive, a high hydrochloric acid content and a low conversion of the starches being the main points for diagnosis. From a case in which from continued dietetic and neurotic causes such test-meals are obtained, and in which the symptoms of flatulency of acid gas or

regurgitation of acid fluid exists, and post-meal distress (pyrosis) coming on when such foods as are in the stomach are supersaturated with gastric juice is present, the correct diagnosis is most often that of excess secretion of the simple type. These conditions usually respond to proper treatment. When they do not, be suspicious of latent ulcer.

Hemorrhagic Gastritis and Other Forms of Gastritis.—The diagnosis between ulcer and the rare instances of hemorrhagic gastritis is exceedingly difficult and most times impossible. The cases of the latter are liable to be in persons in middle life, the onset is acute and the hematemesis may be excessive and repeated in ulcer. The history of pain, hyperchlorhydria and vomiting may be most suggestive of ulcer and still none be present. Even an exquisitely tender localized point pain and area of tenderness may be found. Blood is continuously present in the stools. There is a chance, however, that the diagnosis may subsequently be made in the way of the clinical exclusion of ulcer by the recovery of the case (no complications or sequel). In this it is important to remember that surgery is especially liable to failure in dealing with excessive hemorrhage from the stomach, and thus it is most times advisable to hold to the medical measures of treatment as long as possible. Naturally then, if the case entirely recovers and subsequent examinations are negative one should consider the possibility of hemorrhagic gastritis as a diagnosis of the past condition. In ruptured varix of the stomach in which much bleeding may be present and difficult to control, the classical symptoms of acute ulcer are usually lacking; thus, the distinction of the latter disorder between the two above mentioned. In the ordinary forms of acute gastritis there is always the history of cause followed by acute onset of the symptoms of vomiting of the food and possibly later on by mucus and bile. The pain is not so acute and more diffuse. In the ordinary forms of chronic gastritis the history of cause and the characteristic findings in the various types of gastric analyses are important. When blood or eroded pieces of the glandularis are found the diagnosis of secondary ulcer should be made and the case treated accordingly. The differential diagnosis between ulcer and acute and chronic forms of gastritis as a rule is not difficult. With the hemorrhagic form it is, and the diagnoses of ulcer erosions, or "catarrhal ulcers" accompanying chronic gastritis are usually made by accident.

Pylorospasm not accompanying gastric or duodenal ulcer—which is a most common combination—is a most misleading symptom. It may be present in the neurotic affections of both the stomach and the corporeal types, in cholecystitis and gall-stones, appendicitis, or tuber-

culosis of the abdominal viscera, particularly the cecum and the colon. The diagnosis of pure pylorospasms is usually made by the exclusion of all organic disease and the appearance of spasmodic attacks of pain in the region of the pylorus, with the appearance at the time of intermittent stagnation. The attack usually occurs at the height of digestion, at first rather indefinite and only periodically, but later on more distinct and more often. After a time evidences of gastric dilatation ensue, and vomiting of food late after meals is observed. Following the vomiting, relief for several days may be afforded during which all of the symptoms disappear. During the attack a small round mass (the contracted pylorus) may be felt which is tender on pressure and which disappears in the interval of the seizures. Chronic gastrosuccorrhea may exist, and instances of tetany have been reported. The gastric and feces analyses do not display the presence of blood and may be distinctive from ulcer in other ways. If the case has run a chronic course lactic acid may be present, but Boas-Oppler bacilli are rare.

Appendicitis.—The danger of mistaking cases of perforating acute gastric or duodenal ulcer for appendicitis, and *vice versâ*, is great. In fifty-one cases Moynihan reports that the diagnosis of appendicitis was made nineteen times. According to my observation and experience the latter figure is too high when care had been taken in the clinical analysis of the cases. It is probable that taking only into account the severe instances of the perforative, gangrenous and the rapidly fulminating types of appendicitis, these figures may not be too high. The difficulty is explained by the mentioned types of appendicitis causing rapid production of the alarming symptoms of peritonitis (the same that perforating ulcers produce), which, in a few words, may be expressed as a septic peritonitis of sudden onset, and the fact, as Payr has shown, that there is frequently an association between either acute or chronic appendicitis and erosions and ulcers of the stomach. This author expresses himself as follows: "In a certain number of cases of appendicitis, usually of moderate severity, there appear, shortly after the first attack, various gastric symptoms closely resembling those of gastric ulcer. There is pain, occurring shortly after the taking of food; hyperacidity; vomiting, frequently bloody in character, and, usually later, phenomena suggestive of pyloric stenosis. These symptoms usually abate after a short time, but frequently repeat themselves after each new attack of appendicitis. In other cases it appears more as though the ulcer extended deep into the muscular layer of the stomach and caused chronic inflammatory changes in the serosa. In a large number of cases I have found band-

like or scar-like adhesions in the neighborhood of the gastrocolic omentum or the anterior pyloric wall. In all these cases perforation of the appendix could be absolutely excluded." These stomach lesions he attributes to the result of emboli derived from the thrombosed veins of the omentum and the appendix. According to Mahnert[6] who undertook a clinical confirmation of the frequency and significance of this relationship claimed by Payr, and who studied 36 cases of undoubted gastric ulcer, it was found that chronic appendicitis was present in 23, or 64 per cent. of the instances. While there is no doubt that digestive distress commonly ensues after an attack of acute appendicitis and is present in the instances of chronic appendicitis, I believe these figures to be high in so far as the cases of true appendicitis are concerned. In the argument against the largeness of the figures it must not be forgotten that instances of appendicular disease—even unknown during life—are very common, and the identical may be said concerning ulcered conditions of the stomach. In my experience, nowhere near the proportion of cases in which this association between the two might be present was apparent either after an appendectomy for appendix disease, or the late clinical observation of ulcer cases that had been treated and which most probably did not then have or subsequently developed appendicular disease. So long as persons persist in eating, drinking and living improperly so that causes for gastric disorders are at work, that long must we consider this association to be present in only the small minority of cases, the neurological stomach conditions secondary to chronic appendix disease to be the combination in somewhat more of the instances, but that there is no association of the two conditions at all in by far the largest number. Judging from the large number of cases of gastric disease that come back for treatment for digestive disorder after an appendectomy had been performed, I believe that the average surgeon should be more guarded in promising cure of digestive disorders when an inflamed appendix had been removed. The majority of them are not, and I may incidentally remark that this belief pertains also to the ophthalmologist, gynecologist, and others. Viewing patients as we see them, and not from the dead-house side, the sequence of appendix disease (possibly only the suggestive history of attack), then the onset of gastric disturbance (which on analysis proves to be a *bona fide* condition), and then some strong evidences of chronic appendix disease present are necessary for the logical sequence of cause and effect and before a promise of cure can be substantiated in the majority of cases of appendicular disease treated from the surgical standpoint.

In separating severe cases of acute appendicitis from perforating ulcers of the stomach area the situation of the onset of pain is most important. Muscular rigidity and point pain on pressure and tumor, whether below the transverse line of the umbilicus or above it, are guiding points. When, because of abdominal septicemia or peritonitis, or both together, the abdomen becomes distended, the differential diagnosis is not possible or important, and thus no delay should be permitted. The abdominal cavity should immediately be explored by an incision in the most favorable site and manner for examination of both of the lower and upper abdominal zones. What we are dealing with then are serious consequences, not primary conditions, and these require surgery; the differential diagnosis between the two causative conditions can in every instance be made surer and safer by the surgeon.

Pregnancy with Hyperemesis.—Here the history and the local examination of the case are the best means of making a diagnosis. No pain is present, and the characteristic symptoms of ulcer are absent. The same may be said of the instances of vicarious menstruation, and the various conditions in which blood may be swallowed and vomited or gain entrance into the stomach directly from the gullet or by way of it.

Uremia.—The absence of excretion of urine, or the examination of that obtained will be characteristic. These, with the symptoms of headache, sleeplessness, paralysis, amaurosis, convulsions, mania, delirium, coma, increased arterial tension, and dyspnea are important. General muscular spasm and fever may be present. When consciousness exists the examination of the abdomen is negative, but late in the case distention without rigidity may be observed. The vomiting may be incessant, and if a uremic ulcer exists in the stomach blood may be found in the vomitus or feces. In my experience, the vomitus is usually gastric juice free, particularly when fever is present. This brings me to record the fact, that when for any reason a moderate or high fever has been present for some time (including in the infectious diseases), the vomitus and stomach findings are commonly anachlorhydric and even achylic during its course.

Biliary and Kidney Stones.—The differential diagnosis is often extremely difficult, and may be impossible for a short time. In gall-stones when the tenderness is confined to deep pressure in the biliary triangle and jaundice with bile in the urine and the characteristic pains exist, the diagnosis is easy. But when the pains are constant, as in ulcer, especially after the taking of foods, and with it there is vomiting which affords relief, and the symptoms of gall-stone disease mentioned

above are lacking, time and careful observation are usually required in separating the cases. Cholelithiasis cases are liable to be ruddy in complexion and well nourished, while those of ulcer often display anemia and subnutrition. There is usually a history of long intervals between the paroxysms of pain with a normal digestion. In my experience, the gastric analyses rarely show the presence of blood, although after the paroxysm a positive test may be obtained from the feces—not in the interval. The gas results from test-meals are generally negative, and hyperacidity is common. It must not be forgotten that duodenal or gastric ulcers may exist with gall-stones. In most of these cases the diagnosis of gall-stones is more easy to make than that of ulcer, unless the latter perforates or copious hemorrhage ensues. If a chill with fever, enlargement of the liver, and a swollen tender and palpable gall-bladder exists, the diagnosis is suggested, and this is confirmed should stones be found in the feces in the first few days following the attack. In renal calculus the urine is strongly acid and contains blood, usually enough to give it a smoky tint. Small concretions may be passed per urethra, or observed located in the pelvis or ureter by X-ray. The intensity of the back pain radiating downward (usually only one side) and the absence of pains and point tenderness in the upper and fore abdominal regions are important. The examination of the abdomen is negative, or the entire abdomen may be board-like during the paroxysm of pain caused by the passing of a calculus through the ureter.

Arteriosclerosis.—This occurs in old people, and when sclerosis exists in the vessels of the upper splanchnic area abdominal pains may exist. The characteristic symptoms of ulcer are absent, and the gastric contents commonly achylic. The condition is essentially chronic, and attacks of angina are frequently present. The palpable vessels are firm and arterial tension persistently high until cardiac compensation fails. A large amount of urine may be voided, and this often shows a low specific gravity, a small amount of albumin, and casts of the granular variety. Aneurysm of the large internal arteries may exist.

Spinal Diseases and Others.—Among the conditions that have been mistaken for gastric ulcer are: tabes with gastric crises, myelitis in which pains are a prominent feature, movable kidney, the colic of lead poisoning, enteralgia, herpes zoster involving the lower dorsal nerves and before the eruption has developed, intercostal neuralgia of the lower chest nerves, and diaphragmatic and base pleurisies. The individual features noted by the routine examination will in each of these conditions generally clear up the doubts in differential diagnosis.

DIAGNOSIS OF THE POST-ULCER CONDITIONS.

The subject-matter pertaining to late perforation has already been given (see "Perforation"). It suffices here to repeat that perforation may be met with in the sequent conditions as well as during the course of an acute ulcer.

Perigastritis.—When the ulcer has extended to the serosa and inflammation takes place, a plastic exudation is deposited which usually results in the formation of adhesions. There is no doubt that certain other conditions than ulcer can cause the formation of a localized perigastritis and adhesion formation. Notable among these are the forms of gastritis that are due to recurring attacks of acute gastritis (chronic pyloritis), which, whether from simple catarrhal extension to the outer surface or direct infection from within, subsequently causes the development of the condition. Also, no doubt, infections carried from the gall-bladder, pancreas, liver, appendix, or intestinal canal cause the condition in as many if not more of the cases than ulcer, although here the omentum and other portions of the peritoneum than that covering the stomach are more liable of involvement than that of the pyloric region; tubercular peritonitis must also be mentioned in this connection. Such adhesions, however, are not at all uncommon in cases of ulcer in which cicatrization has taken place, in which instances they are usually perigastric and most often affecting the pyloric region and lesser curvature. Of these Fenwick's statistics show:—

Organ.	No. of Cases.	Per Cent.	
Pancreas alone	49	40.	74.9
Liver alone	33	26.8	
Both pancreas and liver	10	8.1	
Colon	7	5.7	
Liver and colon	4	3.7	
Mesentery	3	2.4	
Spleen	2	1.6	
Three or more organs	15	12.2	

The adhesions occur to neighboring organs and the parietal peritoneum and may be suppurative in nature. At least 7 per cent. of all true ulcer cases show evidences of perigastric adhesions. They are usually observed as well-organized, firm, thick bands, and may extend away beyond the limits of the stomach and even to the pelvis. In ulcers of the posterior wall the pancreas is involved, while those of the anterior or lesser curvature are attached to the left lobe of the liver, the omentum and parietal peritoneum. A triology of organs—the stomach, liver and gall-bladder—may be found bound together in adhesions from the large simple and chronic ulcers of the pylorus.

The symptoms vary according to the extent, degree and location of the perigastritis, to the neighboring viscera affected, and the character of the inflammation—whether plastic or suppurative. In the early stage of ulcer, the onset of the local irritative phenomena (retching, distress and dull pain, and possibly fever) should bring one's attention to serosa involvement. In the average case the symptoms of ulcer predominate, and under treatment gradually fade away, and even when a plastic exudate had taken place which results in adhesions the latter complication or sequel is not recognized for the time being. Later on certain symptoms develop which are characterized by chronicity and resistance to all internal treatments and often are a source of great perplexity, particularly when no history of early ulcer or of gastric disturbance can be obtained. There are certain other features to these conditions that are often helpful in the suggestive way. Among these must be mentioned mild exacerbations of gastralgic pains especially of the radiating character, which may be referred to the back or down the abdomen and which are brought on or intensified by certain movements of the body or occur only when the stomach is distended with food. Continued observance of the cases will often display a slight rise in temperature 37.1° to 38.4° C. (99° to 101° F.) coming and going at intervals and not possible of being accounted for in any of the ordinary medical ways, but which are due to congestion of the adhesions or the mild secondary disturbances that their presence sets up. Some loss of flesh and a persistent degree of subnutrition occurs, but there is no cachexia. On examination more or less indistinct tumor formation may be felt, accompanied with tenderness and resistance on pressure. These are usually subcostal, and unless superficial, may be most confusing. Special examinations of the stomach in the way of inflations do not help one for the reason that the pylorus is deeply set under the liver and its position is not changed to a degree appreciable from the outside. A gastrectasis which follows an ulcer is due either to adhesions that are binding down the pylorus, gall-bladder or liver, to contraction of an ulcer cicatrix bridging the anterior of the organ, or to the onset of malignant disease. Helpful in separating the primary atonies and primary malignant disease from these are the gastric analyses, for in the three above mentioned the gastric findings are usually negative or not pronounced in the ways of noting chronic gastritis and distinct malignant disease. With precardiac perigastritis the signs also vary. Among the symptoms that may be noted here are persistent and difficult to assign attacks of gastric distress, anorexia, local tenderness, recurring attacks of pain, vomiting without gastrectasis, a palpable plaque-like mass, interference with or distress

on deep breathing, or possibly the onset of pains when the stomach is empty so that tension of the stomach parietal adhesions take place. When the adhesions involve the gall-bladder, jaundice may occur which is liable to be chronic and suggestive of malignant disease of the biliary region. The distinction of these cases from malignant disease or uncomplicated cholelithiasis is usually possible after observance of the case. Adhesions affecting the pancreas often lead one to consider the diagnosis of the chronic forms of pancreatic disease (parenchymatous and interstitial). Fatty stools, high albumin loss, many undigested muscle fibers in the feces, the Cammidge test and glucose urine are never observed in adhesions (excepting in the rare instances when the common duct had been occluded). Peritoneal adhesions binding down the lumen of the intestines usually give the symptoms of obstruction in the way of constipation, or, in severe cases, obstipation. In diagnosing perigastric adhesions affecting the regular contour of the stomach or of the colon radiography offers the best means of diagnosis. By this means those obstructing the colon can only be diagnosed as "intestinal stricture," and it is usually necessary to await operation to find out the true nature of the stenosis (adhesions, benign or malignant obstruction).

Cicatrices Causing Pyloric Obstruction.—Following the history of an ulcer which gave clinical symptoms, the onset and persistency of vomiting of the collective type, the evidence of stagnation accompanied with large amounts of hydrochloric acid in the stomach contents, and the objective manifestations of gastric dilatation always suggest pyloric stenoses. Among the conditions in the stomach that would then be present are notably four in number: (1) an unrelenting and contracting cicatrix diminishing the normal lumen of the organ; (2) perigastric adhesions which by traction or binding down cause obstruction; (3) pylorospasm due to the irritation of the pyloric sphincter from the ulcered area; and (4) malignant disease accompanied with extensive connective-tissue deposit, enlarged lymph glands and metastatic adhesions. The clinical distinctions in the way of separating these cases, particularly when no prior history of ulcer can be obtained or is suggested, is usually quite difficult and often impossible. The case which Kussmaul describes (page 388), in which he first used the stomach-pump, answers for any of these (excepting possibly malignant degeneration), and thus will not be repeated. Because of the better diagnostics of the present day and the medical and surgical therapy in the care of these patients, such classical cases as Kussmaul described are few and far between, but occasionally one from some remote quarter will be met with. Very much more often

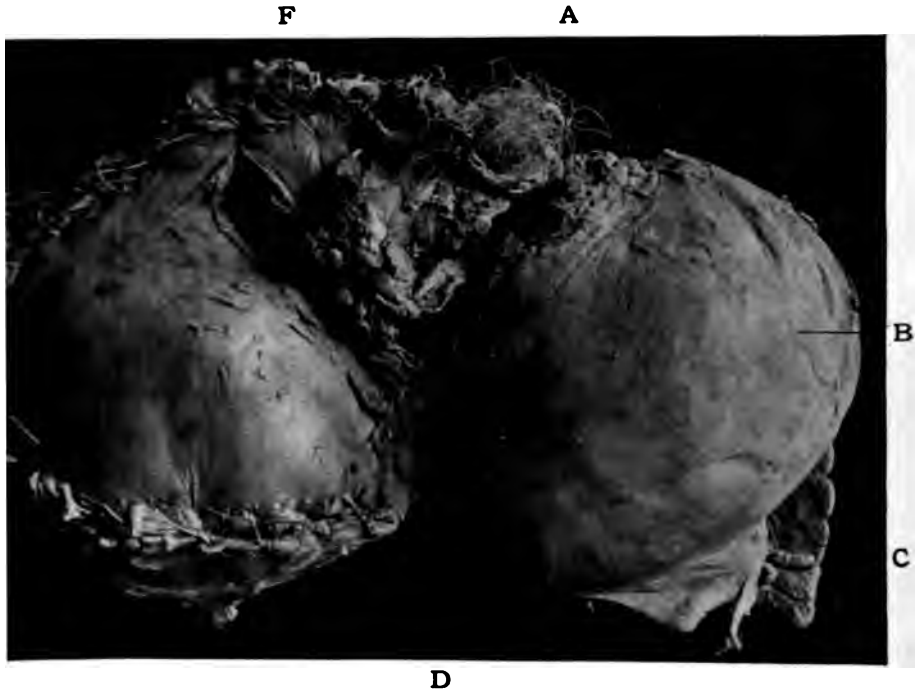
in practice are seen cases in which collective vomiting over such a long space of time is not present, and in these about all we can accomplish in the medical way is to make a diagnosis of pyloric obstruction probably not due to primary malignant disease and continue observance over a length of time. Between cicatricial deposit in the pyloric region and duodenum and secondary pylorospasm the diagnosis is especially difficult, because in the latter the classical symptoms of chronic benign obstruction may exist and at operation the pylorus so freely admits the passage of the finger that organic mechanical obstruction could not be the factor even should the pylorus be somewhat thickened. The diagnosis here is usually suggested in one of two ways: (1) the persistency or subsequent onset of gastric symptoms following an ulcer in a case which on analysis by seven- eight- nine- and so on hour of extraction of mixed meals displays a degree of stagnation with an excess secretion; (2) when there is no prior history of ulcer those that present a gastric atony with high secretion in the production of which no cause can be assigned and which conditions do not improve under local and general treatments.

In thin subjects when the stomach is empty (preferably after lavage) it may be possible to detect a small-sized tumor at the pylorus. In my experience it is generally impossible to say whether the small-sized tumor that is felt is due to a cicatrix or a thickening of the pyloric region secondary to pylorospasm or to a true muscular hypertrophy. Still, in a few instances of pyloric thickening the mass may be definitely made out as localized at the pylorus, and its small, hard feel and movable characteristics may help one. It must not be forgotten, however, that in late ulcer such thickenings of the pylorus are common, and may even be malignant in nature.

In the majority of these cases there is pain (often spasmodic) in the region of the pylorus, which in each instance must be located by the X-ray plate. In slight degrees of stenosis this pain is infrequent, usually not severe, and is relieved or kept in abeyance by a fluid diet. In moderate degrees, it is very much more of a clinical feature, and in stagnant stomachs of a marked degree it may be constant, intensifying at times into severe paroxysms.

Hour-glass Contraction.—This consists of a contraction of the stomach, anywhere between the cardia and pylorus, dividing the stomach into two or more portions. As a rule but two sacs are present, but there may be three or four. The greatest thickening is generally at the cardiac side (which is usually globular), with a thinning out toward the pylorus in a sort of funnel-shaped canal.

PLATE XXXIX.



Hour-glass contraction of the stomach. The constriction from the fundus side just permitted the passage of the index and middle fingers; from the outer side, only the index finger. The specimen is stuffed with curled hair to give it shape. *A*, Cardia. *B*, Fundus. *C*, Spleen. *D*, Constriction. *E*, Pylorus. *F*, Duodenum.

The direct and most common cause for this condition is an old ulcer causing cicatricial contraction and diminishing the lumen of the organ. Outside adhesions are generally also present, and these may alone be the factor in binding down the stomach. Among forty-eight cases reported by Robson and Moynihan, forty-one were due to ulcer. Such stomachs are also produced by carcinoma of the diffuse and connective-tissue type, and a few rare cases have been reported of this condition as a congenital deformity. It is possible also that certain forms of hyperplastic chronic gastritis may, without prior ulceration, cause the condition.

The subjective symptoms are usually variable and indefinite, there being no symptom or symptom-complex that suggests the condition in any instance. Among those that are apt to be present are pain after meals, vomiting of the stomach contents and perhaps also of blood, the ability to eat only small amounts of food, and the onset of acute distress when the capacity limit of the cardiac sac had been reached. The history of stomach disorder generally spreads over a long space of time, may be suggestive of pyloric stenosis, and may or may not have been begun with a definite history of ulcer (in my experience the history of prior ulcer is uncommon). On examination of the patient a degree of anemia, subnutrition, or emaciation are commonly observed. Remembering that the narrowing is usually near the pylorus and that the capacity of the cardiac end is more or less sharply defined according to the degree of contracture, it is easy to understand that this end assumes a globular shape. The constant distentions with food and gas cause a bulging of this sac which often results in rendering more prominent the left costal arch. In one of the cases under my observation this bulging was most prominent after the ingestion of foods, and a distinct peristaltic wave was visible running from the costal arch to about half-way between the edge of the left rectus and the midline. A notch may be felt between the two portions of the organ, and a bubbling and sizzling may be heard at that region as the food passes from the cardiac portion into the pylorus. Patients sometimes describe sensations that correspond with this.

Examination by means of the stomach-tube often gives most valuable suggestions. A return of stomach contents may occur, and after it is supposed that the organ is empty a regurgitation from the pyloric end takes place through the stenosis with the obtaining of an added supply of chyme. The first specimen is usually like an ordinary test-meal, acid in reaction with possibly some remnants from former meals, while the second is liable to be foul and evil-smelling and low in acidity. Moynihan has compiled the following set of symptoms.

First, in lavage of the stomach, all of the fluid fails to return, some, which is in the secondary pouch, being apparently lost (Woelfer's first sign); second, after lavage has apparently thoroughly cleaned the stomach, more contents reappear, probably foul smelling, the washings being again dirty (Woelfer's second sign), or the same may be found on withdrawing the tube after washing the stomach clean and then passing it again; third, the sign of paradoxical dilatation (Jaworski), which consists in the succussion splash on palpitation after apparent removal of all of the contents, and due to fluid being isolated in the pyloric end and thus impossible to obtain; fourth, after percussing out the stomach and thereafter distending it, a change in the position of the distention tumor. While the first two of these may give reliable results in the diagnosis of a case, it must not be forgotten that no contraction may exist and still these be obtained. Not infrequently the presence of a stomach-tube within the stomach and the process of lavage may contract the organ so that at the end of lavage a dirty return will follow the clear. Also, on a few occasions, I have cleansed the stomach and at the end met with chyme that had regurgitated into the stomach from the duodenum—usually, however, during the process of lavage the flow is the other way and some of the washings are lost into the intestine.

The one method of examination *par excellence* for diagnosing these conditions is resorting to the X-rays. In suspicious cases the morning stomach should always be washed before the drinking of the bismuth mixture. After this about ten minutes of time should be allowed before the exposure is made so as to allow the bismuth to pass into the pyloric pouch. The plate should be made with the patient standing, or prone with the abdomen down. The gastroscope may serve of value in some of these cases, although a good radiographic examination is usually sufficient for diagnosis.

Persistent Excess Secretion.—It has already been mentioned that a number of cases that clinically appear to be those of gastrosuccorrhea are instances of ulcer more or less healed. Whether in these conditions the secretion is raised as an effect of the ulcer on the organ, or had existed before the development of the ulcer and had persisted, is always an impossible thing to say. As cases of ulcer exist with a normal or subsecretion and as gastrosuccorrhea often exists without ulcer it is reasonable to infer that ulcer is not such a potent factor in raising the status of secretion as was formerly supposed. That the combination of the two commonly exists and that there is a connection between hyperacidity causing ulcer there are no doubts, but I believe that ulcer causing hypersecretion does not occur unless stagnation

from the ulcer exists. In other words, I believe that resulting pylorospasm, contraction of cicatrix, or the binding down of adhesions causes an interference with the proper emptying of the organ, and thus the condensation of the acid content. Naturally, when a history of past ulcer is obtained and in the presence of a gastrosuccorrhea the above conditions should immediately be thought of; but these are the cases only rarely met with in practice. In my experience, and I have seen many cases of true gastrosuccorrhea, a history of ulcer was not obtainable or even suggested, and a diagnosis of gastrosuccorrhea was the only one that could be made; certainly in the early instance. It remains then to be observed as these cases work out under treatment as to whether a post-ulcer condition is present in that individual case or not. Those that clean up after a length of time and remain so for months when on a simple régime most logically are dietetic in nature. But when, on the other hand, these are not so favored and the gastrosuccorrhea persists, the possibility of ulcer should be thought of. The closest observation is then necessary to arrive at diagnosis, and all of the subject-matter pertaining to the diagnosis of ulcer should be taken into consideration in the examinations for the purpose of eliminating ulcer. The different hour extraction of mixed meals, and the observance of the gas results from simple meals may give most important clues. These, along with the others mentioned under ulcer and the X-rays have served me well in diagnosing eleven of such cases. Still, at least as many more have been beyond me, and in those I have had to resort to surgery both to diagnose the case and to relieve them by having a gastroenterostomy performed (which is the most efficient way to relieve the subjective symptoms of persistent secretion). The therapeutic use of the X-rays may be employed before resorting to operation.

Persistent Irritable Stomach.—In practice these are also of two kinds: first, the persistent gastralgia that follows ulcer; and second, a persistent gastralgia for which no cause can be assigned and which does not respond to proper measures of treatment. Essentially, gastralgia is a condition with a cause, is easily and successfully treated, and does not persist for lengths of time. When such symptoms as pain, more or less vomiting and hyperesthesia persist after an ulcer, the diagnosis is easy. But when these symptoms develop and persist and states of excess secretions or the corporeal neurological condition can be ruled out, the differential diagnosis is always difficult. The therapeutic use of the X-rays will no doubt serve to detect a few of them because true ulcer cases usually improve on this treatment; with this, of course, all other medical measures are included.

Erosions of Vessels.—Following the repair of an ulcer, a corrosion of the margins or autodigestion of the central portions of the cicatrix may occur with bleeding. The above title refers particularly to these, and does not deal with latent or chronic ulcer or malignant degenerations in which more or less hemorrhage usually occurs. Thus it is, that the conditions referred to are those that follow an acute ulcer, either within a short time or at a late interval. Usually when an acute ulcer is healed, latent hemorrhage is not observed. But there are not a few instances in which, because of incomplete repair in the first instance or the development of the conditions mentioned above after it, that hemorrhage may be met with. For this reason, it is advisable to make gastric and feces analyses in all cases of acute ulcers during the first year after apparent recovery so as to note if this adventitious condition is present. I personally believe that a persistent high stomach secretion is the main factor in the production of intercurrent bleeding, because it has been my observation at autopsy that a hemorrhagic or new ulcered area at the margin of an old scar is not uncommon. Possibly, added to this in its production, is the stiffness and inelasticity of an old cicatrix, which, with the soft glandularis bordering it, and the motility of the organ keeping up more or less of a bending motion at that point, a dissolution of tissue takes place.

Manifestly, the symptom of importance is hemorrhage, which in extent may be all the way from a copious hemorrhage when a large vessel is opened, to the subtle form which is small in amounts but more continuous. These patients may give no direct symptoms at all, or may have more or less gastric distress. However, when the hemorrhage has been continuous, the symptoms of anemia with loss of weight develop and may not respond or remain permanent to treatments directed to the general condition. The conditions are important for the reason that upon such scars carcinomatous degeneration is liable to occur.

Chronic Ulcer.—While from a clinical standpoint it serves to no purpose to separate the acute from the chronic forms of ulcer, still, a distinction between the two forms exists. Up to the present time all of the post-acute ulcer conditions have been classed as chronic ulcers. This, in my opinion, is confusing because there is a type of ulcer which possesses anatomical features distinct from the acute ulcer, and differs from it in its clinical course in the way that at best it shows but little disposition to healing. Such ulcers are usually irregular in shape, presenting a shelved or terraced formation, and in the beginning are soft, but which in the course of time usually display more or less connective-tissue deposit. This is particularly the type of ulcer which is

PLATE XL.

Old cicatrix in the stomach, the result of an acute ulcer which gave beginning symptoms some years before. Note the hard, contracted and raised ridge of scar tissue, in the center of which are seen areas of necrosis due to strangulation of the circulation, caused by the contraction of the fibrous tissue, and the digestion of same by the stomach secretions. To the right and left of the ridge are seen fan-like radiations of scar tissue over the free surface of the organ. The contraction of this scar was very evident on the outside of the stomach before it was opened for examination. It is evident that upon an existing formation like this a malignant growth (in the course of time) could make its beginning. (Actual size of the specimen.)

e to undergo carcinomatous degeneration with the production of :linical entity designated as ulcus carcinomatosum.

As a rule, there are no distinctive clinical features to this type of - excepting that the symptoms of ulcer persist over a long course me. In the beginning it is rarely possible to conclude whether ulcer symptoms present are those due to the acute punched-out - or the chronic form. But in the presence of pains, nausea, vomit- stomach misery, hematemesis, anemia, emaciation, etc., persisting e face of all treatment the occurrence of this type of lesion should ought of. These cases are usually met with in those well on in

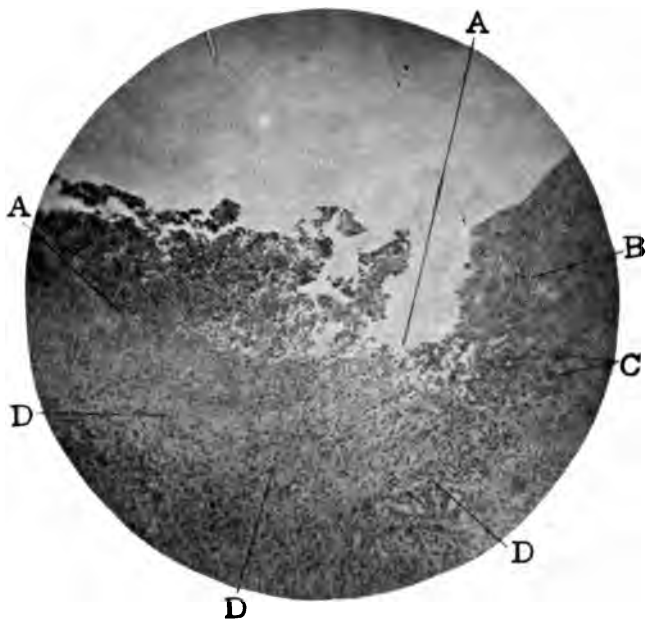


Fig. 91.—Photomicrograph of a chronic ulcer of the stomach. *A, A,* lcer pit filled with detritus and cells. *B,* Granulative tissue. *C,* Remains f a few gastric tubules which beyond the granulative tissue were found uite normal. *D, D, D,* Thickened and infiltrated submucosa. × 84.

lle life, and, in my experience more frequently in men than in en, and in those who present the evidences of general arterial ge of senility—namely arterial sclerosis. Such ulcers also com- ly present the complications of perforation, hemorrhage, perigas- ; with adhesions or abscess, stenosis of an orifice and other rmities of the organ.

Carcinomatous Degeneration.—The possibility of this condition was first suggested by Cruveilhier in 1835, noted by Rokitansky in 1839, and the first series of cases were analyzed by Dittrich in 1848. The latter author observed that in 166 cases of cancer of the stomach. the cicatrices of ulcer were present in 8, and in 2 the malignant disease began from the very edge of the ulcer. Since that time a number of observers have advanced statistics proving the connection between the two, but it remained for Graham working at Mayo's clinic to show that the prior figures were much too low, and that ulcer was probably a strong factor in the production of cancer in 61 per cent. of cases of malignant disease.

It is essential to recall that the pylorus and lesser curvature are the commonest sites of both ulcer and malignant disease, and that scars in these locations are subjected to more or less constant or intermittent irritation. While arguments have been brought to bear against trauma or other forms of local irritation not being an exciting cause for the development of malignant disease, it is difficult for one in practice to feel otherwise than that these are most important factors in cancer of all organs. Upon erosions and small-sized ulcers at the edge of the cicatrix, or as a result of the gastric juice digesting away central portions of the contracting scar and the development of irritation upon the neoplasmic cellular elements in the cicatrix, a carcinomatous degeneration may begin which soon spreads beyond the confines of the ulcer area. In the beginning, such ulcers usually possess but little in the way of appearance to suggest the presence of malignancy and the aid of the microscope is necessary to observe this. Such ulcers may resemble the chronic type, although occasionally the edges are rounded and the entire ulcer much stiffer and harder in feel. In such instances perigastric adhesions with any of the surrounding organs or enlarged lymph nodes may be found.

The diagnosis of these cases in the early instance is exceedingly difficult and may be quite impossible. In my experience the cases are clinically met with in one of these ways: first, the case that gives a history of at some time having had an ulcer, and in which the diagnosis of any of the mentioned post-ulcer conditions comes up; second, the case which clinically represents a chronic ulcer that has continued over a space of time and slowly and progressively are developed the symptoms of emaciation, anemia, more persistent vomiting, and the onset and a rise in lactic acid with possibly a few Boas-Oppler also present; and lastly, the late cancer cases in which the diagnosis of malignant disease is simple. Considering the difference in the gastric analyses between cases of distinct acute ulcer and cancer, it is plain

that when the malignant process has just begun or is rather sharply confined to the ulcer area, the diagnosis is difficult. It is important, however, to remember that as the malignant process advances such stomachs are liable to decline in acid-enzymotic secretion with the occurrence of lactic acid and the organisms and more steady bleeding. These cases may for a space of time continue at a steady weight (particularly when on the fluid albuminous foods) even though cachexia gradually develops.

But there always comes a time when a loss of weight begins which is beyond what one might account for in ulcer, and when once started it is usually progressive. More or less pain is generally present from the beginning, but this is peculiar in the way that it is not so liable to be as definitely associated with the ingestion of foods as in ulcer, and is more constant in a low degree than it is in cancer. I have observed in several instances, and I feel that it is a practical point, that an ulcer case that persists in all of the ulcer symptoms and then claims to have less of the sharp pains than before was present is liable to be one of malignant degeneration. Such cases also may at first have a sharply localized area of tenderness (ulcer) which subsequently becomes less acute but more diffuse. The onset of gastrectasia should also be closely watched, and, most important of all, the general condition of the patient. In these ways some of the cases can be diagnosed, but as surgery is indicated in all of the benign post-acute ulcer sequelæ, in chronic ulcer, and in malignant degeneration, resort to operation is after all the best and safest means to arrive at diagnosis. In the predicament of indecision that usually assails one in these conditions, and the great dangers of temporizing until too late, it is indeed a blessing that exploratory incision under the modern methods is such a safe, simple and valuable diagnostic procedure. The matter should be placed squarely before the patient, but of course not before all medical methods of diagnosis have been exhausted. The responsibility of the rejection or adoption of exploratory incision is then upon the patient, and we have done our duty. Intelligent persons usually respond to the advice, the ignorant and those who lack in courage usually require more suffering to bring this about. It is in influencing the latter that most of the discouragements are met with, and the more direct and pointed the advice and the less the arguments, the more willing ones there will be for the proper course to pursue.

Tetany Due to Ulcer.—Tetany is commonly associated with old ulcers in which dilatation has occurred. This is seen in all grades from slight irritability of certain peripheral nerves with paresthesias—usually those of the face or of the extremities—to marked and steady

seizures accompanied with coma and death. It usually occurs in pyloric stenosis of the benign type, but may be present in malignant disease. As to whether it is due to deficiency of water in the organism, to a reflex irritation of the nerve center from the irritated nerves of the gastric mucosa, or as a consequence of an intoxication of the organism by abnormal products of metabolism in the diseased gastro-intestinal canal is still a mooted question. But it can occur as a sequel to ulcer, and has been reported by Albu to be the cause of death in 31 out of 40 cases. The symptoms are those of gastric stagnation and dilatation of a chronic type.

THE COURSE, DURATION AND PROGNOSIS OF GASTRIC AND DUODENAL ULCER.

The statistics pertaining to the cure of acute ulcer conditions can only be formed from the medical standpoint and only be gathered after at least one year has followed the termination of treatment. The figures advanced by surgeons show altogether too high a number of unsuccessful results of medical treatment in so far as the acute ulcer and erosions are concerned, and deal mostly with the complications and post-ulcer sequel. Leube's early statistics claimed 50 to 75 per cent. of cures after four to six weeks of medicinal treatment, and Lenhartz's results seem to give a more favorable outlook. Remembering that only about 25 per cent. of ulcer cases present clinical symptoms so as to make diagnosis easy, and that at autopsy at least twice as many scars as first ulcers are seen, it must be evident that even the figures of Lenhartz are much too low. In my opinion, acute ulcers (including erosions) are curable by medical means or occur by no special means at all in at least 95 per cent. of all cases, and it is from the remaining 5 per cent. that the surgical statistics are gathered. It must be that the figures of mortality from all kinds of ulcers variously given as between 10 and 20 per cent. pertain only to the most serious types of this disorder and still fall far short of including all of the ulcer cases that exist.

From the surgical standpoint we have some reliable figures on hand as to results of treatment of the complications and late conditions in serious cases of ulcer. In these, of course, the results from medical treatment established at the time of operation were poor, particularly because they comprise the small percentage of about 25 per cent. of the plainly clinical ulcers that are not followed by recovery. The question that surgeons advance to internists, "How can you determine whether an ulcer is healed and be sure that no complications exist or sequelæ may occur?" is of course well taken, and quite impossible to answer

satisfactorily so as to cover the full breadth of the subject. There are so many varieties of these conditions, the possibility of sequelæ must always be thought of, and such a difference in treatments and ability and time for observation with different physicians that figures which would represent cure with one might be quite worthless to another. We can only say, that a case which ran the clinical course of ulcer, or without these was diagnosed by medical means, in which a full return to health took place, and persisted that way for one year, is logically a cure, but that even in a very small per cent. of these surgery may at some time be indicated.

As loss of tissue in the human body is replaced by a cicatrix (excepting in some instances of nerve sections) this formation is the result of acute ulcers. The chronic forms of ulcer do not show such a disposition to scar-tissue formation as the acute and usually remain more or less open. The sequelent conditions are essentially chronic, and malignant degeneration is progressive to fatality unless operated upon in time. Excepting in overwhelming hemorrhage when a large vessel is opened, the intermittent hemorrhages are acute and liable to recovery, and the continuous forms chronic and usually requiring surgery. Ulcers which give distinct clinical symptoms are (unless early perforation occurs) medical cases, and when properly treated tend to complete recovery in at least 75 per cent. of the instances; the remainder that do not are always surgical.

The prognosis of acute ulcer depends upon each individual case. Only according to the depth, extent and charácter of the lesion, the careful and continued handling of the case in the first instance when the diagnosis was made, and the willingness of the patient to follow directions and to remain under observation for some months, can the prognosis be established. We should, excepting possibly in the successfully handled, mild, or moderate case, never be too optimistic. In the severer ones it is wisest to be conservative and always watchful, for there is no always nor never in ulcer.

TREATMENT OF GASTRIC AND DUODENAL ULCER.

Prophylactic.—These may be divided into those that have to do with preventing the occurrence of ulcer, and those which have to do with minimizing the danger of return or the development of the post-ulcer conditions; both of these, however, will be presented together since there is nothing particular to either one.

The most important matter is the subject of excess secretion. In these the treatment should be as outlined in Chapter XXVIII. In addition, all matters pertaining to the general state of health and

nervous symptoms should receive attention. Anemia should be corrected by a full diet and the use of the hematinic tonics, and states of debility and subnutrition should be cared for by high caloric feedings and the employment of supplemental meals of a fluid albuminous character. Every effort should be made to work down the stomach secretion and work up the general state of health, and in the latter the hygienic measures often offer most substantial aids.

When the diagnosis of ulcer has once been made or strongly suggested, the patient should be put to bed, and the strictest discipline in the way of complete rest, dieting, medicine and hygiene insisted upon. In this way the case can be more satisfactorily controlled, and the results of medical treatment are better. Even in erosions at least four weeks in bed should be insisted upon and preferably six. Failures in medical treatment come from indifference or incomplete discipline, and by its observance the dangers of hemorrhage and perforation are minimized. After this, the transition from rest in bed to walking about should be gradual and spread over two weeks longer. In a successful case that is without symptoms a return to the ordinary fare can then be commenced, although certain of the irritating foods and foods in quantities should be interdicted for a length of time. As regards diet there are certain rules applicable to all cases. Coarse vegetables and cereals, highly seasoned foods, made-up dishes, hashes, salted and preserved meats and fish, and soups made of meat should be excluded. Preserved fruits, pickles, fresh berries, or vegetables with seeds and also nuts are dangerous. As regards beverages, beers, ales, wines and liquors of all sorts, as well as tea and coffee should not be drunk. Gruels, milk soups and purées, and other foods cooked with milk are useful. Water, milk, Vichy and cocoa are the best fluids. White bread may be eaten. Tender beef, lamb, chicken or fowl and fresh fish may be taken once a day, but advice should be given that these must be roasted or broiled, and, after being finely cut on the plate, should be swallowed only after thorough mastication. Eggs in any form with but little salt may be taken as often as desired. The cereals and vegetables should be well cooked, and potatoes and other tuberous vegetables mashed before eating. The plan of the late diet should be fluid or semifluid foods or solid foods finely comminuted, the quantity at each time small and the amount of seasoning as low as possible, with the taking of supplemental meals of the fluid albuminous foods in the midmeal period and before retiring. The foods taken should not be too hot or too cold.

In the first month or two when patients are on a mixed diet, rest for one or two hours after meals should be insisted upon and also

the avoidance of all business and irritating topics of conversation. If a hyperacidity persists or works up again when a mixed diet had been established, the use of bismuth subcarbonate, the mineral alkalies, plain Vichy, the oils, or atropine should be given. The bowels should be moved with Carlsbad salts, magnesia hydrate, or by enema, never by the other purgatives—not even cascara sagrada—and no pills or hard tablets should be taken. If patients can afford it, a sojourn in the country, or a course of treatment at Carlsbad, Vichy, or Ems should be advised. Beginning about two months after the conclusion of active treatment and at regular intervals during the first year gastric analyses should be made and the feces examined for blood. If the acidity runs up, or blood appears in the stomach contents or feces, or gastric distress ensues, the case should be more rigidly disciplined and treated, and perhaps again put to bed for a week or two. If gall-stones or an appendicitis are present operation should be advised and insisted upon.

Dietetic.—A controversy has raged in recent years as to the best plan of diet to employ in the treatment of acute ulcers in the way as to whether this should be one of starvation and scant fare, or liberal feeding. The fact of it is that the stomach and general conditions of body are met with so differently in different cases that no one rule is applicable to them all. One patient will do best on early and rather full feeding as recommended by Lenhartz, and another case becomes distinctly worse until complete rest of gastric activity has been carried out for several days as practised by von Leube. In so far as the stomach is concerned, it seems that results depend upon the elements of gastric and pyloric spasm, freshness of the ulcer, amount of bleeding and vomiting, and the general excitability of the organ; in these instances rectal feedings and only very small amounts of food by mouth should be employed until the symptoms abate. If the case begins or becomes compatible with high feeding, the patient should be fed; if made worse by feeding, a severe modification in the quantity is advisable, or a few days' abstinence from mouth feeding should be instituted. As a rule, it is better to accept von Leube's advice for the first few days, and Lenhartz's after this to the termination of the four weeks of treatment. Less severe cases occur in which the Lenhartz method of feeding should be started in the beginning of treatment, and also more severe cases in which the Leube principles of feeding are necessary for a continued time.

There are several matters pertaining to the two dietetic methods of the first few days that should be mentioned. The first is, that if resort to mouth feeding or to a fuller fare is long delayed after the

use of the rectal enemas a distention of the stomach with a sudden increase in acidity is liable to occur and these may precipitate vomiting and directly or indirectly prevent the healing of the ulcer. The second is, that, because of the nature and quantities of food, the Lenhartz feeding is very liable to work up or keep high the excess acidity of the organ, and in this way a cure of the ulcer is wrought but a high status of gastric secretion is left, which, as was mentioned before, is against prophylaxis of a return or a better state of stomach condition in the post-ulcer period.

The dietetic treatment inaugurated by von Leube and von Ziemssen is rest in bed, and nutrition by the rectum or by food which burdens the stomach as little as possible. As modified by Ewald,[7] this author describes his own treatment as follows: "For the first three days absolutely no food is to be administered by mouth, but a nutritive enema is given three times daily; subsequently, besides the enemata, milk or milk in flour soup, in teaspoonful doses, or bland pigeon or chicken broth. The milk, on account of its fine floccular coagulation, has some pegnin added. If this diet is well borne, it is added to in a manner soon to be described; otherwise, absolute rectal nutrition is again instituted. If no pain follows the careful administration of milk, we may permit somewhat larger quantities (up to a flat plateful, *i.e.*, about 180 cubic centimeters), leguminous flour soup, then legumes; later pappy food made of chestnuts, sago, tapioca, Kufeke's flour, hygiama and others, and later small quantities of meat. Among nutritive substances cows' milk takes first place; it was first advised for this purpose by Cruveilhier. It is suitable because it contains all of the nutritive elements in solution, that is, finely subdivided, is free from irritating substances, because the acid is neutralized, and because the coagula which form from the action of the gastric juice remain soft. The patient, however, must drink it very slowly and lukewarm. To prevent the flocculent coagulation of the milk, and the irritation of the ulcerative surfaces due to this, I now add pegnin (lab-ferment), which produces a very fine flocculent coagulation. Besides pigeon or veal soups, the yolk of an egg, and beaten-up egg albumin, pulverized meat or leguminous soups may perhaps be given. We must limit ourselves to these foods until the severe symptoms have disappeared. In the third week a food richer than this, both quantitatively and qualitatively, is permissible, and we should then carefully try food of somewhat greater consistence, such as scraped raw ham, raw or very soft boiled eggs, scraped venison or breasts of fowl, rolls or zwieback softened in cocoa, but milk is always preferable, and we should always be ready to return to a simpler diet as soon as the symptoms, or even

pains, appear." It will be noted that this diet has as its main feature stomach rest, and that no particular effort is made to supply caloric values equal to the maintenance of nutrition or to encourage the repair process of the ulcer. The diet of Ewald may be considered as a conservative and rational combination of well-tried methods. Arguing for its use in the preference to that advised by Lenhartz, he reports to have had but 4.8 per cent. of hemorrhage after the thorough institution of treatment by limited feeding; whereas, Lenhartz, in 201 cases, had 6.4 per cent. of hemorrhage.

Starting from the fact that hyperchlorhydria, chlorosis and anemia frequently develop in the course of ulcer, Lenhartz has advised the use of quite a different dietetic treatment. Even in cases of hemorrhage and severe symptoms this author permits his patients from the start to take concentrated foods rich in albumin. Among the results that he has reported are that in sixty cases treated by the diet (with rest in bed, applications of ice, one or two grammes of bismuth daily, and, perhaps, iron with arsenic) only one case proved fatal, seven had relapsing hematemesis, and that the pains ceased almost immediately after the ingestion of food rich in albumin, and the patients recovering more rapidly than those on the more modified diet. Of these sixty patients, twenty-five were subsequently questioned and eighteen (72 per cent.) were entirely free from symptoms. Although this number of cases is much too few to draw any very useful deductions, they still represent a slightly better figure than Leube first claimed (50 to 75 per cent.). Lambert gives the results of treatment according to the method of Lenhartz in eight cases, which were all severe, as—"All of the patients were benefited by the treatment, and, except those with stenosis, all were cured. One of the cases recovered after distinct failure with the other treatment." He concludes as follows: "This series does not warrant the conclusion that the original claims of Lenhartz are correct; first, the cure is at least equally as efficient as the other method, and that it does not deplete the patient; second, the cure is more rapid as well as more certain; third, the vomiting and bleeding stop more quickly and relapse is less frequent than in the Leube cure; fourth, the pain ceases promptly and morphine is never needed; fifth, the food supply is sufficient throughout; sixth, it is possible to treat the anemia earlier with iron and arsenic than in the Leube cure; and seventh, it is possible for the patients to return to a full diet and to their usual occupation earlier than in the older cure."

The routine of the Lenhartz plan of feeding is as follows: Food is administered in small quantities at one-hour intervals. Slow mastication and slow eating are insisted upon, and these are accomplished by

feeding the patient with teaspoonful amounts at each mouthful, and by never allowing him to feed himself during the first two weeks of the cure. Three or four weeks' rest in bed is insisted upon in each case. An ice-bag is applied to the epigastrium to relieve the pain, and bismuth subnitrate is administered internally for hemorrhage. The preparation of food used during the first weeks is as follows: The raw eggs are beaten up whole and iced. Both the milk and the eggs are placed in covered glass tumblers surrounded with cracked ice and kept at the bedside. The feeding spoon is also kept iced. The eggs and milk are administered in alternate feedings. Granulated sugar is added to the eggs on the third day. The raw, scraped beef, boiled rice and zwieback are prepared in the usual manner.

The routine of administration is the following:—

Day.	*Eggs.*	*Milk.*	*Sugar.*	*Scraped Beef.*
1.	2 drams each dose. Total, 2 eggs.	4 drams each dose. Total, 6 oz.		
2.	3 drams per dose. Total, 3 eggs.	6 drams per dose. Total, 10 oz.		
3.	½ oz. per dose. Total, 4 eggs.	1 oz. per dose. Total, 13 oz.	20 grammes added to eggs.	
4.	5 drams per dose. Total, 5 eggs.	1½ oz. per dose. Total, 1 pint.	Same.	
5.	6 drams per dose. Total, 6 eggs.	14 drams per dose. Total, 19 oz.	30 grammes.	
6.	7 drams per dose. Total, 7 eggs.	2 oz. per dose. Total, 22 oz.	40 grammes.	36 grammes in 3 doses.
7.	4 drams per dose. Total, 4 eggs. Also 1 soft-boiled egg every 4 hours. Total, 4 eggs.	2 oz. per dose. Total, 25 oz.	40 grammes.	70 grammes with boiled rice; 100 grammes in 3 doses.
8.	Same as above.	2½ oz. per dose. Total, 28 oz.	Same.	Same.
9.	Same as above.	3 oz. per dose. Total, 1 quart.	Same.	Beef, same; rice, 200 grammes; zwieback, 40 grammes in 3 portions.
10.	Same as above.	Same.	Same.	Same.

Add cooked chopped chicken, 50 grammes; or ham, 50 grammes, and butter, 20 grammes.

11-14. Interval of feeding made two hours. Milk given in 6-oz. doses, with ½ oz. of raw egg. Butter increased to 40 grammes, and chicken or ham as above.

At a recent German congress of internal medicine, Lenhartz reported his results in 295 cases of gastric ulcer treated according to his principle of a more nourishing diet than that allowed by von Leube which has been a standard for so long. In 262 cases there had been a hemorrhage before the treatment was commenced, and in 33 the stool contained blood, but his total mortality was 2.3 per cent., and only 18 cases had hemorrhage after treatment was commenced. Making comparisons with Lenhartz's results, von Leube replies to Lenhartz maintaining that his thirty years of experience and especially the 627 cases of gastric ulcer in which he has applied his "rest cure" during the last eleven years have fully confirmed the advantages of his technique, while he sees possibilities of danger in following Len-

hartz's directions. He reported that fully 90 per cent. of his patients were cured; 8.5 per cent. improved, and only 1 per cent. failed to benefit, while the mortality from hemorrhage was 0.3 per cent. He is convinced that the only way to induce the production of the life-saving thrombus and thus check the tendency to hemorrhage is to keep the stomach absolutely at rest; the patient is kept in bed with a single dose of 30 drops of a 1 per thousand solution of adrenalin supplemented by bismuth, an ice-bag over the stomach, an injection of morphine to keep the stomach quiet (never for its pain-reducing properties) and complete abstinence from food by the mouth. Ingestion of egg or milk may bind the acid, but at the same time they stimulate the peristaltic movements of the stomach which it is the aim of treatment to avoid. Only after the stool has lost its admixture of blood and other signs show that the hemorrhage has been arrested, which is usually the case in two or three days, he then cautiously commences a liquid diet in the course of one or two days. The patients may lose in weight at first, but they have made it up and more by the end of the second week. He restrains from iron on principle, saying that ulcer patients do not seem to tolerate it well, and study of twenty-five cases on the liquid diet for two weeks did not show any special reduction in the hemoglobin. Laxatives must be strictly avoided. The four elements of his "rest cure" are the absolute rest in bed; one glass of tepid Carlsbad water twice a day, fasting, hot flaxseed poultices renewed every ten or fifteen minutes and applied continuously for twelve hours, at night a wet linen cloth being substituted. The special diet completes the course of treatment, and he emphasizes the fact that the combination of these four factors is indispensable for the best results, and that complete abstinence from food until the hemorrhage has been arrested is the only safe and commendable method.

As was mentioned before, the choice of the two methods of feeding depends altogether upon the intensity of the gastric symptoms and the general condition of the patient. In one, the Leube method is indicated, in another, the Lenhartz, and in still another, first the Leube and then the Lenhartz, or possibly the other way. No definite rules can be set down to meet all cases and the physician must choose for himself in each instance which is the best course to pursue. Formulas for the nutritive enemata will be found in Chapter X. The occurrence of occult blood in the feces during the course of treatment and in the early days afterward usually requires transition to a more generous diet; but sometimes it is best stopped with lower feedings.

Medicinal Treatment.—The most generally employed drug in the

treatment of gastric ulcer is bismuth subnitrate. The beneficial results from the use of the insoluble bismuth salts have been variously described, but it is most probable that they are wrought by their acting as a mechanical sedative in the way of inhibiting the secretion and motility by coating the mucosa and thus keeping the gastric contents away from direct contact with the glandularis and the ulcered surface. According to Thesen,[10] the benefit of bismuth is ascribed to a disinfecting action on the ulcered surface, and also to the possible fact that the bismuth albuminoses formed are taken up by the lymph and are carried into the lymphatics where they exert a direct curative action on the lymphangitis. However the benefits are obtained, cases do better when one of these salts has been used and also when the subgallate is used in hemorrhage and the subcarbonate in high acidity. By their use the pains are lessened, the vomiting and hemorrhage are controlled, and in a few days the stomach becomes generally more tolerant.

The best results from its employment are obtained when the dose is large and when taken into the empty organ. At least two and often preferably more grammes should be given at a time, either in plain boiled or in barley water. Some authors recommend the taking of only one large dose in the mornings, but, because in the average ulcer case the organ is quite emptied of bismuth in from four to six hours, it is best to give it in smaller quantities, 2 to 4 grammes (30 to 60 grains) at about the above intervals. There is one drawback to its use that is occasionally observed and that is its constipating effects on the bowels and this is particularly true of the subgallate. This, however, may be obviated to an extent by combining the bismuth with magnesia usta (as below) or suspended in olive oil, by the use of Carlsbad salts each morning, or an enema.

℞ Bismuth subgallate, subcarbonate, or subnitrate,
Magnesia usta .....āā 40.0 ʒx
Fiat pulv. no. x.
Sig.: Take one every five hours in barley water.

To obviate the danger of nitrate poisoning such as may occur when the subnitrate salt is used in large doses over a continued time, it is best to employ the subgallate or subcarbonate in the first instance or substitute these for it in a few days. The administration should be steadily continued during the first two weeks of treatment and then in smaller doses for as long as may be indicated. For the treatment of gastric ulcer I am not in favor of the Fleiner or the Cohnheim method for the reasons that the daily passing of the stomach tube is required in both, and that results from them are not any better than

the Leube or Lenhartz treatments. Olive oil, however, used in Cohnheim method, may be a valuable adjunct to the treatment in the way of relieving the pain, vomiting and pyloric spasm by holding in check the acid secretion and forming a protective coating to the ulcer. It may be given (drunk) in one- or two-ounce quantities and serves as a good vehicle for any of the bismuth salts. Many patients object to the taking of olive oil by mouth, claiming that it nauseates them; in these instances it may be used as Cohnheim suggests (run down through the stomach-tube), but not in the early days of treatment when the dangers of perforation and hemorrhage should always be thought of.

At the end of the first week plain Carlsbad thermal water or still Vichy may be used as a drink. These may be given a wineglassful at a time and preferably at the room temperature. The Carlsbad salts may be used to relieve the constipation and it is important to remember that this is about the only purgative salt that is tolerated by these stomachs, Epsom, Rochelle and others being very liable to cause acute gastric distress. The dose is a teaspoonful in a glass of warm water drunk slowly early mornings.

A drug of the greatest value in the treatment of acute ulcer is belladonna or its alkaloid atropine, preferably the first. It seems strange that a medicament which in its physiological action combines so many features of benefit should not have received more than a passing mention and consideration. Rather generally in the therapy of excess gastric secretions its use is advised, and it often serves to good purpose as a symptomatic medicament. But even in these the beneficial results are never as marked as they are in ulcer. Quoting a recent article in which I drew special attention to its use in the treatment of gastric ulcer (Bassler[11]) the following may be repeated: "While the Lenhartz treatment possesses worthy advantages in the way of maintaining better general nutrition, and thereby indirectly favoring better repair of the ulcer, there is one factor in its use which has not received enough attention, and this is that in the larger quantities of protein given (while such might bind the excess acid for the time being) it also encourages a higher secretion of it because of the chemical nature and quantity of the food taken (coaptation juice of Pawlow). It is plain, therefore, that while this treatment is indicated in one way, it is counter-indicated in the other. For this reason, the use of belladonna (or atropine) taken by mouth is a measure worthy of adoption in the cases in which excess secretion and motility exist, rather than the one of increasing the quantities of protein as the gastric function is 'worked up.' Belladonna is a drug which combines

the faculties of controlling secretions and movements of the gastro-enteron. It can be given along with the Lenhartz treatment, or employed when no food is given by mouth. When begun, its administration should be steady in moderate-sized doses, and continued until its constitutional physiological effects are obtained. This is usually brought about, in the average case, by 0.5-gramme quantities of the tincture, given at three- or four-hour intervals, in about two days. At the onset of the symptoms due to the drug, its employment should be continued in about one-third of the above-mentioned quantities, and maintained all of the time that the patient remains in bed. The running amounts of the drug then taken should always be short of again producing or maintaining the physiological effect produced in the first instance. In cases of acute gastric ulcer which present marked vomiting of sanguineous acid fluid or intense boring pain in the stomach after feeding the use of belladonna is often most striking in its results. It seems as if that when the gastric secretion and motility are held in check by its use the subjective symptoms are at once ameliorated, and since apart from the comparatively slight disagreeable features of dryness of the fauces, dilatation of the pupils, etc. from it, it is the medicament *par excellence* for these cases, and about which, in this connection, the following advantages may be enumerated:—

"1. It effectively and always positively controls excess secretion and motility, thereby favoring repair of the ulcer.

"2. It holds in check the worked-up stomach secretion which the Lenhartz treatment is liable to bring about, and thus holds back hydrochloric acid to be bound by the proteids.

"3. It has a better effect on the relief of the symptoms of pain, vomiting, hemorrhage and local gastric distress than any other medicament—bismuth, silver nitrate, the alkalies and morphine all included.

"4. It does not interfere with the binding or digestion of the protein content of the Lenhartz feeding, since such acid as may be secreted the protein will care for, and such excess proteins not so met with can be cared for in the small intestine.

"5. It is easy of administration to these patients in the way of being small in dose, almost tasteless, easily borne, does not interfere with the digestion, and can be taken on an empty stomach.

"6. And lastly, the great bugbear of distention of the stomach of an atonic nature is not brought on by its use when only the smaller-sized doses are employed in the running way after the first few days."

The principal drugs used for their astringent action and in the hope of stimulating the ulcered surface to cicatrize are nitrate of silver

and perchloride of iron; of these, the first is the more generally employed. Silver nitrate, which has also been recommended as an antacid, may be given in pill form 0.015 to 0.03 (¼ to ½ grain) at a dose, or in solution with a small amount of sodium bicarbonate (0.5 to 1.0). Boas used silver nitrate in solution 0.25 to 120 cubic centimeters, and gives it in gradually increasing strength up to 0.5 to 120 cubic centimeters, adding peppermint water to prevent nausea; of these different strength solutions a tablespoonful is taken on an empty stomach three times a day. To prevent the conversion of this salt into a chloride, the solution must be given through a tube, or in the form of soft pills. Up to the present time, I have not observed any special desirable results from the use of silver nitrate. Of course, cases are met with in which it may be believed that benefits come from its use during the acute stage, but it must not be forgotten that recovery in ulcer is often most rapid, and occurs even in spite of improper treatment. However, the silver solution seems to answer to some value in the late treatment, and I think that when employed as a sprayed solution it serves to the best advantage.

Leube's method in full comprises the following: The patient is placed in bed for ten days, during which time the epigastrium is washed with alcohol and sublimate solution, then boric ointment is applied on a thin cloth, and over this a hot flaxseed poultice every fifteen minutes for ten hours during the day and a wet compress during the night. After the tenth day, an abdominal flannel binder is worn during the day and for three weeks a simple cold compress at night. During the convalescence, the patient rests completely for two hours after meals. The counter-indications for poultices are menstruation and recent hemorrhage (within three months), preference being given to an ice-bag when recent hemorrhage occurs. One pint of Carlsbad water is drunk slowly in the morning for one month; and alkaline waters during the day. Bismuth and sodium bicarbonate may be used. The constipation is treated by enemata of tepid water or Carlsbad salts, or, after the eleventh day, by 4 grammes (1 dram) of a powder consisting of powdered rhubarb 20 parts; sodium sulphate 15 parts; and sodium bicarbonate 7½ parts. For the first ten days the diet consists of boiled milk and Leube's meat solution, and soft, unsweetened zwieback. Then for the next week, rice or sago soups, boiled with milk or white of egg, and soft-boiled or raw eggs. Later on tender meats, and after the fifth week careful ordinary dieting.

Treatment of Individual Symptoms.—For the pain, if severe, a hypodermic or two of morphine may be necessary in the first day or

two. In my experience this rarely is called for, belladonna internally and possibly also codeine answering for most all cases. Einhorn recommends the use of chloral hydrate as a sedative and antiseptic combined, but in my belief it is too irritating to the stomach mucosa in these cases even in only 2- to 5-grain doses. Orthoform or anesthesine may be employed in severe cases. Usually, however, when the rest and diet has been instituted, a wet compress over the abdomen is soothing and answers to control the pain. For the purpose a so-called "sweat bandage" may be employed which is easily applied in the following manner: A large soft towel is soaked in cold water and wrung out so that it does not drip. This is then folded lengthwise and wrapped around the waist of the patient, over which rubber sheeting or oiled silk is placed, and then a dry towel to bind these in place; this bandage is changed two or three times in twenty-four hours. In place of this an ice-bag or flaxseed poultice may be used on the epigastrium, whichever affords the greatest relief.

For the vomiting, bismuth, belladonna, ice, and opium suppositories are recommended. It usually subsides in a few days of routine treatment and thus requires no special attention. When this is severe, however, I have observed much benefit come from the use of a sinapis plaster to the epigastrium, which, when the skin is well reddened, is immediately followed by an ice-bag.

For the anemia, albuminate of iron may be given, as Ewald suggests, by adding 4 cubic centimeters (1 dram) of a 2-per-cent. solution of iron sesquichloride to 2 ounces of albumin water. One or two teaspoonfuls of liq. ferri albuminati, or liq. ferri peptonati cum mangano may be given thrice in twenty-four hours in a little water. In the late treatment the astringent forms of iron and arsenic answer to the best purpose. The following is particularly to be recommended:—

℞ Acidi arsenious	0.03	gr. ss
Ferri sulphatis	7.0	ʒij
Kali carbonatis	3.5	ʒj

Fiat pills no. xxx (soft).
Sig.: Take one pill three times a day.

For hyperacidity, bismuth subcarbonate, belladonna, and the mineral alkalies and alkaline mineral waters are employed. Although it is generally advisable to use these separately, the following combinations may be employed:—

℞ Belladonna pulv.	2.0	ʒss
Sodium bicarbonate	30.0	℥j
Calcined magnesia	40.0	ʒx
Talc. pulv.	15.0	ʒss

Fiat pulv. no. xxx.
Sig.: Take one powder in water every four hours.

Or, the following of Stoctons:—

℞ Cerium oxalate	1 part	or 10.0
Bismuthi subcarbonate	2 parts	or 20.0
Magnesium carbonate	4 parts	or 40.0

Fiat pulv. et Sig.: Take half a teaspoonful every four hours.

When a copious hemorrhage is present a hypodermic of morphine, which is the best internal hemostatic we have, may be necessary. For the less severe forms, adrenalin chloride solution 1 to 1000, 10 to 20 drops, three or four times a day may be effective. Bismuth subgallate, absolute rest and quiet, and small pieces of ice to suck may answer. Ewald uses ice-water for lavage, and others again recommend gelatin-water. When the pulse is very small, anemic murmurs appear, or cerebral anemia occurs, normal saline infusions are indicated. If given subcutaneously, a rather large cannula should be used and the injection made deep into the subclavicular region or under the breast in the female. The solution should be at the temperature of the body, and at least a liter introduced at one time. When the hemorrhage is moderate and continuous and the patient shows constitutional effects from the bleeding, the saline solution (7.5 to 1000) may be introduced in a steady way by the rectum route using the Murphy method for the purpose.

Lavage of the stomach is essential if much fermentation of the gastric contents is present. This, however, is rarely seen during the course of acute ulcer, and is more apt to be met with late when stenosis or marked atony exists.

The advent of a perigastritis usually required a prolongation of the treatment in bed, and possibly the use of opium suppositories, or cocaine internally to relieve the pain. The use of the latter is often serviceable.

℞ Opium pulv.	1.5	gr. xxv
Bismuthi subnitratis	30.0	ʒj
Prepared chalk	25.0	ʒvj
Sodii bicarbonatis	30.0	ʒj

Fiat pulv. no. xxx.
Sig.: Take one powder every four hours.

Therapeutic Use of the X-rays.—For the repair of gastric ulcer, a cicatrix must be formed which is smooth and even on the gastric side and complete in structure. There is no doubt that the commonly seen aftermath of symptoms in cases of acute ulcer coming on after or existent from the acute clinical days are as often due to an incomplete state of the repair of the glandularis and resulting unfavorable conditions persisting in the stomach as are these symptoms due

simply to a persisting or resulting hyperchlorhydria, sensory disorder of an irritative type or resulting atony. In fact, it must be the first thought of the attendant in every case which, after leaving the bed, continues to complain of gastric symptoms, that the ulcer is not in a good state of repair, rather than assuming that the cicatrix is perfect and that now only a neurotic condition exists. A cure is a cure in all that the term means, and not an assumption based solely upon the fact that at one time the patient was in bed for weeks and now he is about again.

We are familiar with the mysteriously wrought beneficial effects of the X-rays in skin affections, particularly its stimulating properties in the repair of cutaneous ulcers of all types and its discutient effect on cicatricial conditions, such as may be seen in scars of healed furunculosis of the neck, cicatrices from injuries, keloid, etc. Now, if such can be accomplished in the skin, have we not a reason to believe that ulcers or cicatrices from them in the stomach (which when empty is not much less accessible to the rays than the skin) may likewise be favorably influenced by its use? My interest in the use of the rays began with a case of acute gastric ulcer which persisted in giving gastric distress after the acute stage, and in which surgery seemed to be the logical therapy to advise. Since then I have used the rays in 27 other like cases (28 in all) with the result that 15 of them are to-day entirely well in so far as their gastric symptoms and what I could learn from test-meal and feces examinations and clinical physical measures are concerned. The remaining 13, all late ulcer cases, showed no benefits from the treatments, and, excepting 2 that died as a result of operation, were finally relieved by gastro-enterostomy. In addition to the above, I have treated with absolute success 4 cases of chronic ulcer in the aged.

The above cases represent individuals who were seen by me the first time more or less late in the course of this condition, and had been diagnosed and treated by others before I saw them. Judging from their histories and my own examinations I believe each of them to have been cases of gastric ulcer of the distinct clinical type, either before (acute) or in the four chronic ulcers, at the time that I saw them, and that in each of them an ulcer or an incomplete repair or an irritated or stiff scar existed at the time I first saw them.

While the therapeutic use of the rays is by no means a panacea in the treatment of such conditions and is not offered as a substitute for surgery, it is, in my belief, a measure which, along with dieting, medication, etc., is worthy of adoption in post-ulcer conditions, such as irritable stomach, excess secretion, recurrent hemorrhage, chronic

ulcer; firstly, because its use will not interfere with any medical treatments that may be instituted in the case; secondly, its use seems to be logical and harmless; and lastly, because of the success achieved in these cases. One must be careful, however, since these patients are usually so anxious about themselves, impressionable to psychic influences, usually neurotic from long-standing pains, age, etc., that the benefits are not suggestive in nature, and that the subjective benefit derived is not put down to a better state of stomach conditions, unless such can be proven by test-meal or feces examinations, or by physical methods. Anxious as I am that the X-rays will receive a more extensive trial in these cases than is possible by me, I would much prefer that such good results as may be reported would be *bona fide* ones in only plainly evident cases of these conditions. Only in this way and with a much greater number of such cases treated than I have had, could its true value be learned. Of late I have used and advised its use in every case of acute gastric ulcer I saw beginning with the time that the patient left the bed. It is usual to find that during the course of treatments the excess of HCl secretion becomes less; whether this is directly brought about by a better state of repair in the stomach, an atrophic effect on the acid cells in the gastric tubules by the rays, or only indirectly so, I am unable to say. In seven of my cases slight gastric bleeding existed in a continued way, and the hemorrhage stopped in all in about the third week of treatment. The stomach usually becomes less irritable to foods, and thus post-meal pain and distress, nausea and vomiting are controlled, and as these subside patients take more food, digest it better, and improve generally.

The technique of the rayings was simple, consisting of exposures of the center of the upper abdomen, every other day until the skin showed changes from the rays. The exposures were then discontinued for a while, and begun again in the course of two or three weeks until at least twenty-five exposures had been made. The stomach should be empty at the time, a tube of medium hardness employed, and the treatments given in the prone position. In a skin that will stand it and in an improving case, the rayings may be kept up for a number of months, or until it is probable that no further benefit from them can be derived.

The cases I reported at the time I drew attention to the use of the X-rays for this purpose (Bassler[11]) and in which the results were striking are the following:—

CASE I.—K. M., trained nurse, German, single, 42 years of age; habits good; well nourished, not neurotic. *History:* After several weeks of an ill-defined indisposition, in which anorexia, gastric pains after eating and general weakness were

features, she was seized with violent pains in the stomach and vomited large quantities of blood from a gastric ulcer. She was taken to the German Hospital, New York, and remained in bed for five weeks, and was treated by the usual methods of rectal alimentation, gastric medication, etc. A second hemorrhage of large quantity occurred while there. Leaving the hospital, although careful how and what she ate, she continued with pains in her stomach, more or less steady nausea, and occasional vomitings. This history ran on steadily, sometimes better, sometimes worse, for over five months, when she went to Kissengen and took the course at that spa and after which she felt somewhat better. Shortly afterward she again began with sudden attacks of pain and nausea coming on at indifferent times. It may be reported she had a paroxysm just before leaving Europe for this country, and another the day before the boat landed, with more or less constant gastric distress in the interval. *Physical examination:* Having examined her before she left for Europe and when she returned, I report my findings on both occasions as follows: Her localized area of tenderness in the epigastrium (about 7 centimeters below the ensiform and in the median line) continued to exist. She could bear no pressure upon the lower gastric region (even slight) and was constantly guarding herself from these. Her stomach was slightly ptosed and plainly dilated when she came back, probably due to the drinking of much water at the spa. She had an increased gastric secretion with hypermotility at both times, but no evidence of stomach bleeding at either time; if anything, she was worse on her arrival here than when she left, and soon began to vomit more frequently and completely. Other findings negative, excepting that she had a moderate anemia. *Diagnosis:* Incomplete repair of a gastric ulcer, and anemia. *Treatment:* After about fifteen rayings she developed an X-ray dermatitis, two weeks after which she began again and was treated all told about thirty times. Her improvement in subjective gastric symptoms began at about the sixth raying and continued until they had practically disappeared which was about when the dermatitis occurred. As she improved, she grew less careful in the selection of foods and could eat almost everything, without distress, although she continued moderately cautious. When her gastric distress began to disappear her excess secretion and hypermotility became materially lessened. No medication had been used excepting simple ones to regulate her bowels. She is now at regular work nursing and massaging and apparently well again, excepting at times she has slight distress when she eats too heartily. In the first two months of X-ray treatment she improved in general health from a very ill-looking woman to one apparently well. She was under my observation for over a year and had no gastric symptoms. About eight months after her discharge she complained of pains in her back when lying down. These grew worse and she went to Dr. W. J. Mayo and was operated upon on the supposition that she had some perigastric adhesions from the ulcer. Dr. Mayo's report of the findings at operation were: "Stomach normal in every way; cholecystitis, the gall-bladder containing several ounces of thick, dark bile and was drained: appendix removed." Since then the back pains have subsided. The cholecystitis was probably responsible for the gastric ulcer—a not unusual complication—but I feel that the rayings were helpful to the stomach condition, although manifestly they could not benefit a chronic cholecystitis.

CASE II.—A. G., cook, Frenchman, married, 52 years old. Slight in build and somewhat nervous in nature. *History:* Had syphilis at 20 and was under treatment for it for two years at the time. For fifteen years had more or less trouble with his stomach, never severe or causing much interference with his work. The

main symptoms in these attacks after meals were a feeling of weight and pressure in the epigastrium accompanied by pyrosis and retching of gas. At these times more or less regurgitation of foods took place, and occasionally vomiting of the stomach contents. In the past three months he has lost nineteen pounds in weight, probably due to the fact that everything he ate and drank distressed him acutely and consequently he partook of too small quantities to maintain his nutritional equilibrium. Habitually constipated. *Physical examination:* Body shows considerable emaciation. Mucous membranes pale; tongue slightly coated in center, edges clean; teeth good; slight pharyngitis; heart, lungs and kidneys normal. Reflexes slightly exaggerated. Upper sections of the recti tense, rest of the abdomen fairly flaccid. Has a localized area of tenderness 6 centimeters below the ensiform and to the left of the median line, and another left of the spinous process of the tenth dorsal vertebra. The slightest point-pressure on the abdominal area causes him exquisite pain. Stomach slightly dilated. *Laboratory findings:* Ewald test-meal extracted by aspiration the next day showed total contents 90 cubic centimeters increased mucus, free HCl 40°, combined HCl 35°, total HCl 75°, and total acidity 91°. Lactic acid present in slight amounts (Kellings by ether). Blood present in slight amounts (benzidin and guaiac). Microscopic examination showed a poor state of carbohydrate conversion, some red blood-cells, a few leucocytes, a large number of squamous cells and some free nuclei, and an increased bacterial flora mostly of the staphylococcic type. After a purge and meat-free diet of two days, his feces showed a slight amount of incorporated blood (aloin), a high albumin output, about one-quarter quota of bacteria of which the anaërobes were increased in number, and a thick layer of mucous coating in the surface of the feces. Blood count: 3,400,000 reds, 7750 whites. Hemoglobin 81 per cent.; polynuclears 71 per cent. *Diagnosis:* Chronic gastric ulcer. *Treatment:* The diet was limited to milk and eggs given in quantities representing 2000 total calories a day. Atropine sulphate in 1-200 grain doses was given every four hours, with an occasional morning dose of Carlsbad salts to correct the constipation. The rayings were begun at once. After the second week (sixth raying) the man had made such improvement locally that he was put upon a semisolid diet, the atropine discontinued, and on a mixed diet about four weeks later. These meals he now readily partakes of with but slight gastric distress in which pains are not present. He had gained 27 pounds in weight, is generally much stronger, and says he feels better than he had in years. Briefly stated, three test-meals extracted afterward did not show the presence of blood, gave a lower acidity, and a lower total amount than the first examination. A specimen of feces, three weeks after beginning the rayings, still showed the presence of incorporated blood, but in those following this no blood at all; altogether over ten months of time, seven examinations of feces were made in this case.

Surgical Treatment.—Depending upon the number, extent and depth of ulcers, where they are situated, the length of time and the character of treatment employed, and the willingness of patients to observe the post-ulcer advice given, the results of medical treatment vary. It is for these reasons that statistics of medical failures have been reported as all the way from less than 1 per cent. to as high as 22 per cent. However, even under the best of conditions, and in the best of hands, failure is met with, and particularly is this true in perfora-

tions, the post-ulcer sequelæ, and chronic ulcer. Uncomplicated ulcer is always a medical condition, at least in its early stages.

Surgical interference, on the other hand, shows a most gratifying diminution in mortality and greater number of successes each succeeding year. Beginning with modern figures, those of Hartman, 1895 to 1899, 23 cases with 6 deaths, 25 per cent., may be taken as the start, and those of Moynihan's, 251 gastro-enterostomies, etc., for simple chronic gastric or duodenal ulcers, including hemorrhagic cases and hour-glass stomach, 3.5 per cent.; and Mayo Robson's, 210 gastro-enterostomies, etc., 3.8 per cent. may be taken as the last authentic figures. It really seems not too much to expect that future years will show a still less rate of mortality, and for this reason it seems logical for the internist to early refer those of the acute cases to surgery which do not make favorable progress under the medical treatment.

Carrying consideration to the clinical side of the subject, it may be stated that in hemorrhage of the copious types one often meets with failure in surgery. The reasons for this are that these patients are usually but poorly able to withstand the shock of operation, it is often impossible to find the bleeding vessel, and an immediate gastro-enterostomy generally serves to poor purpose in checking the hemorrhage. Von Leube found uncontrollable hemorrhage to be the cause of death in only 1 per cent. of his cases, and surgery, even in the best of hands and under favorable conditions, cannot offer better results than this. For these reasons it is desirable to withhold operation, accepting it only in those which have a continuation of recurrent hemorrhages after careful treatment.

Perforation, however, always requires surgical procedure, the percentage of recoveries from medical treatment being only about 5 per cent., while that of surgery when instituted early enough being over 65 per cent. The question of doing a gastro-enterostomy after the perforation has been closed (advised by many surgeons because of the multiplicity of ulcers) depends upon the site of the perforations and the condition of the patient. The nearer to the pylorus and when in the duodenum and the larger the rent, the greater is the necessity for better stomach drainage. In favorable cases, a gastro-enterostomy should be performed in each instance, for by it rest of the stomach occurs, dilatation soon disappears or is obviated, the stomach secretions become more normal, and the influx of bile and pancreatic juice into the stomach does no harm, at least not for the time that the perforation is healing. But, on the other hand, when, after the perforation is secured against further leakage and even when in doing

this the pyloric region may be somewhat narrowed, if the general condition of the patient is not good no further surgery should be done. On a number of occasions I have advised against further surgery, even against stern arguments of operators who were fearful of the narrowed pylorus, and every one of the cases have fully recovered without requiring subsequent operation for this narrowing.

When the diagnosis of perforating ulcer of the upper abdominal area is made, the patient should be placed with shoulders down and hips raised, and kept in that position until the abdomen is opened; this prevents the spreading of the infection to the lower abdomen. No foods or stimulants should be allowed by mouth, and peristaltic rest should be secured by application of cold to the upper abdomen and perhaps the use of opiates for the time being before operation. If the shock is severe an intravenous injection of salt solution materially improves the condition. The operation should be accomplished in as short a time as possible, since time is vital. Murphy,[12] whose advice on the post-operative case of perforation cases is particularly instructive, advises a continuous proctolysis of normal salt solution when the patient is returned to bed after operation. This author states that he has given 30 pints of normal salt solution in twenty-four hours to a patient eleven years old, and that the retention of fluid in the colon depends entirely upon its method of administration. The fluid should be administered through a fountain syringe to which is attached a ⅜-inch rubber hose fitted with a hard rubber or glass vaginal douche tip with multiple openings. This tube should be fixed almost to right angles 3 inches from its tip. The tube is inserted into the rectum to the flexion angle, and is secured in place by adhesive straps binding it to the side of the thigh so that it cannot come out. The rubber tube is passed under the bedding to the head or foot of the bed, to which the fountain is attached. It should be suspended from 6 to 14 inches above the level of the buttocks, and raised or lowered to just overbalance hydrostatically the intra-abdominal pressure—*i.e.*, it must be just high enough to require from forty to sixty minutes for 1½ pints to flow in, the usual quantity given every two hours. The flow must be controlled by gravity alone and never by a forceps or constriction on the tube, so that when the patient endeavors to void flatus or strain the fluid can rapidly flow back into the can, otherwise it will be discharge over the bed. It is this ease of flow to and from the bowel that insures against overdistention and expulsion. The tube should not be removed from the rectum for two or three days. When the nurse complains that the solution is not being retained it is certain it is not being properly given. Murphy regards, next to the conserva-

tive technique of the operative procedure, proctolysis as second in importance as a life-saver.

Of the post-ulcer conditions that require surgery may first be mentioned hour-glass contraction. In these a communication can be formed between the two sacs by the performing of operations designated as gastroplasty and gastrogastrostomy. These are performed with or without gastro-enterostomy according to the requirements. When the contraction is in the pyloric region and partial, the ideal operation is partial gastrectomy, which removes the total area of disease and unites the divided healthy ends of the stomach. Gastro-enterostomy alone usually affords but little relief to these cases, for to be sucessful both sacs should be connected with the intestine and this is a serious operative procedure and the dangers of a vicious circle are doubled. The mortality of these operations for this condition have been variously reported from different sources, but about 15 per cent. can be taken as the mean average of them all.

Post-ulcer cases that develop gastric atony are those secondary to pyloric stenosis, or the primary form. When the first mentioned is met with it is well to first temporize for a time with a special diet consisting of fluids and semisolid foods and the solid foods in finely comminuted form. The meals should be frequent, about three or four hours apart, and the quantity taken at each time small. But after a week or two of treatment, if relief is not afforded, the performing of the operations of partial gastrectomy and gastro-enterostomy is to be advised. The instances of incessant pains from old perigastric adhesions may be temporized with by medical measures and the use of potassium iodide or syrup of hydriodic acid. When the suffering is not relieved, and the patient shows advancing debility, anemia. emaciation, etc., surgery is indicated.

In post-ulcer persistent gastrosuccorrhea and hyperesthesia or gastralgia, operation should be withheld until a thorough course of medical treatment and the use of the X-rays have been tried. These cases, with instances of recurrent bleeding, often clear up sufficiently for comfort, and in accomplishing this a return to the rest treatment for two weeks or so is sometimes desirable. If, however, in the face of strict régime and thorough treatment, any one of these conditions runs a chronic course, operation is in order. Here partial gastrectomy is the first choice of operation, and gastroenterostomy the second.

True chronic ulcer is generally a surgical condition. However, the use of special dieting, bismuth, belladonna, rest, the X-rays and the tonics would be advisable for a while. In the failure of these, mixed treatment should also be tried for a short time, for in a few

instances it may give most surprising results. As a rule, the only operation that can be performed is gastro-enterostomy. This is unfortunate because these are particularly the types of ulcers that are liable to undergo carcinomatous degeneration and thus should be excised.

Carcinomatous degeneration is always a surgical condition, and excision of the diseased area and the surrounding adhesions with the enlarged lymph glands is necessary.

It may lastly be mentioned that when results from medical treatment are not or apparently would not be successful, the patient should be assured by the physician that nothing can be accomplished by internal means and the point of the lack of danger in exploratory incision should be dwelt upon. Only in these ways is it possible to get the majority of the patients to consent to operation.

References.

[1] Bassler: "Gastric Exfoliation as a Feature in the Production of Acute Gastric Ulcer," Medical Record, November 30, 1907.

[2] Ewald: "Modern Clinical Medicine." Billings: "Diseases of the Digestive System," p. 168.

[3] Martin: Osler's "Modern Medicine," vol. v, p. 208.

[4] Bönniger: Berliner klin. Wochenschrift, 1908, Nov. 8, p. 396.

[5] Einhorn: Medical Record, April 3, 1909.

[6] Mahnert: Mitth. a. d. Grenzgeb. 1908, xviii, p. 469.

[7] Ewald: "Modern Clinical Medicine," vol. v, p. 202.

[8] Lambert: American Journal of the Medical Sciences, 1908, No. 1, cxxxv, 18.

[9] W. von Leube: Deutsche medizinische Wochenschrift, Berlin, xxxv, No. 22.

[10] Thesen: Norak Magazin f. Laegevidenskaben, Christiania, lxviii, No. 2.

[11] Bassler: "Some Medical Considerations in the Treatment of Gastric Ulcer with Special Reference to the Use of Belladonna and X-ray Therapy," Medical Times, vol. xxvii, p. 259, Sept., 1909.

[12] Murphy: "Surgery, Gynecology and Obstetrics," June, 1908.

CHAPTER XXI.

Organic Diseases of the Stomach.

(Continued.)

GASTRIC CARCINOMATA.

(Carcinoma Ventriculi.)

PRELIMINARY REMARKS.

THE stomach is more frequently affected with cancer than any other organ of the body, comprising about one-fourth of all cases. Haeberlin[1] first pointed to the fact that the frequency of gastric cancer is steadily increasing, and Bryant,[2] who compiled statistics of cancer cases in the United States from 1850 to 1890, showed the deaths per 100,000 living to be: 1850, 9.0; 1860, 11.7; 1870, 16.0; 1880, 26.05; 1890, 33.5. It is probable that the death rate to-day is melancholily higher. According to Welch, cancer of the stomach is the cause of death in 1 per cent. of all persons dying after the age of twenty years. It occurs in men a little more frequently than in women, the average being about one-fourth as many cases more. It is most common in the light-skinned races, the pure-blooded negroes being practically exempt. It is said to be rarely found in Egypt and in some of the South American countries.

Cancer is a disease of late middle life; the average age at death in 600 cases which Britton collected was fifty years. The same authority gives the maximum liability between sixty and seventy. Welch's statistics of 2975 cases of stomach cancer show the following according to the ages: 10 to 20, 2; 20 to 30, 55; 30 to 40, 271; 40 to 50, 499; 50 to 60, 620; 60 to 70, 428; 70 to 80, 140. According to this the maximum liability lies between the fortieth and sixtieth year. Cases in younger life are rather rare. Mathieu, up to 1884, collected from literature 27 cases of gastric cancer below the thirtieth year. The author has observed 2 cases of stomach cancer in early life, both in young men, one at twenty-five, and the other probably beginning at the twenty-ninth year. Cases have been reported in persons much younger than this, some as early as the tenth year.

unusually rapid cell multiplication results from the consequent increased food supply.

PATHOLOGY.

The four types of cancer met with are: the adenocarcinoma, the medullary, the scirrhous, and the colloid.

The adenocarcinoma, cylindrical cell or epithelioma, forms soft, fungating tumors, presenting well-marked nodules and sloughing. These often display a papillary appearance of a red color which is due to each fungosity having a small loop of blood-vessels. This latter reason accounts for the commonly observed hemorrhage on the surface and in the substance of the growth, and the blood or so-called carcinoma juice usually found within the cavity of the stomach. The specific type of cell is columnar in shape, and they are found lining numbers of newly formed tubules and mostly in the superficial portions of the pseudo-tubules. Lower down the cells are more irregular in shape, although large spaces may be seen lined with well-formed cylindrical cells. The connective tissue generally displays marked leucocyte infiltration. Small cysts containing granular matter and liquid are rather commonly seen.

The cylindrical cell carcinoma is most commonly found in the pyloric region close to the orifice. Probably because of this reason the cancer mass may grow to considerable size before the development of secondary carcinomata, although at autopsy these are extensively found in the glands, liver, lungs, etc. Ulceration of the free surface of this type of growth is commonly seen, the necrosis often extending deep into the mass or through the entire stomach wall. These growths often show a marked tendency to undergo mucoid degeneration.

The medullary, or soft glandular, carcinoma likewise presents fungating masses projecting above the mucous membrane. It is soft and spongy in nature, having little connective tissue, is rich in blood-vessels and cells, and on cut surface it is usually of a grayish-yellow color. This type of cancer bleeds readily, and at autopsy is generally found extensively ulcerated, presenting a scooped-out appearance with a projecting surrounding wall. The bowl-shaped central depression may extend down to the inner muscular coat. The soft, glandular cancer usually rapidly invades the outer gastric layers, forming small nodules on the external surface, enlargements of the lymph-glands, as well as surrounding involvement in adjacent structures. This neoplasm seems to have a predilection for dissemination through the lymphatic system, usually being found in all of the sur-

rounding lymphatics and in the left supraclaviculars. Numerous cancerous nodules may be seen scattered in the abdominal and chest cavities. The primary growth may be found in any part of the stomach, although it is most common in the pyloric region.

The scirrhous, or hard glandular, carcinoma is distinguished from the other types mainly by its hardness, which is due to abundance of connective tissue and relatively few cells. The growth has a compact, massy hardness, cutting with considerable resistance and with a gritty sound. Portions of the tumor are of a cartilaginous nature, and of a whitish-yellow color in which are seen striations of dense cicatricial tissue. This growth shows little inclination to ulceration in its early state; but in late cases superficial ulcers may be found on the mucous surface. When these are found, they are shallow and flat. Typical cancer proliferation is often difficult to find in the primary growth, and may only be seen in the secondary cancer formations. For this reason when the cancer is small and confined to the stomach walls, it may present the macroscopic appearance of an old chronic ulcer. Extensive adhesions of the pylorus to surrounding organs (liver, intestine, omentum) are almost always present. Cancer formation is usually found in the lymphatic glands, and may even extend into the spinal column directly or indirectly from the primary growth. For the reason of its involving adjacent tissues, large masses may be found outside of the stomach, while the gastric growth may be small and overlooked. The secondary growths, as a rule, are richer in cells and may present quite a medullary appearance. For the reason of its dense stroma, contractions are common, and, as these tumors almost always are present at the pylorus, they give rise to marked pyloric stenosis. When much of the stomach wall is involved, the entire stomach may be stiffened and contracted. In these instances, the gastric mucosa may be destroyed, either by thinning, actual loss of tissue, or by chronic inflammation, thus giving the picture of a gastric cirrhosis or extreme hyperplastic gastritis; the latter two are often conditions secondary to the presence of the neoplasm.

The colloid, or gelatiniform, cancer is simply one of the preceding forms which has undergone a mucoid or colloid change. Colloid cancers are most frequently met with in the stomach, intestines and elsewhere in the abdomen. The tendency of abdominal tumors to undergo colloid degeneration is as yet unexplained. In character this growth is typical. The very fine stroma with the mass of mucocolloid material in its meshes gives it a light-grayish color and a soft, slimy feel, and the tumor is usually rather indefinite and irregular in shape. The growth seems to have the faculty of marked progression, since

PLATE XLI.

Adenocarcinoma in the posterior wall of the stomach near the pylorus but not actually involving the lumen of the latter. This fact permitted good exit of the food from the stomach, and that accounted for the small degree of gastric dilatation. The growth is seen in the upper part of the picture and to the left. In the center of the flat fungating tumor is seen a small ulcer due to sloughing of the degenerated and hemorrhagic area at that point. This growth followed more outward into the glandulature than into the depths of the organ and did not involve the peritonial coat. Because of its relatively small mass and softness no tumor was palpable from without.

PLATE XLII.

eneral scirrhus carcinoma of the stomach. The rest of the tissues, other than omach, have been cut away so as to show the actual characteristic growth the walls and cavity of the organ. Tracing from the pylorus will be noticed e sized carcinoma nodule beyond the pylorus extending into the lumen of the num; then the pylorus itself with its general involvement, its thickening of the a and musculature; coming downward into the cavity will be seen a running tion of malignant growth, in characteristic nodules, which extends through- l of the glandulature even to the fundus, smaller nodules can be seen in the of the organ; at the point of the dip of the lesser curvature will be seen arked hypertrophy of the musculature, probably due to the effort that such nach must have made to expel its contents through the obstructing way l it. The entire organ was stiffened by the callous growth. The peritoneum greater and lesser curvatures is seen to be much thickened.

PLATE XLIII.

carcinoma of the stomach. The growth is at the pylorus, and repre-
characteristic diffuse thickening in the stomach walls of this type of
will be seen to have involved all of the structure of the stomach at that
l beyond it into the surrounding tissues. In appearance it was gelatinous
ss, and cut through the stomach walls with a gritty sound like a
Beyond this the growth was of a soft slimy consistency. A carcinoma
en in the stomach proper left of the center. The pylorus is horizontally
this point.

inosis often extends into the peritoneum and the omentum may be id broadly involved. Affections of the lymphatic glands, liver, gs and other organs are common, and colloid material may be id infiltrating throughout the gastric walls, intestines and lymph-sels—this latter medium may account for its so general involve-it of adjacent structures. The cancer is usually observed at the orus, from which it may extend directly into the duodenum and icent liver. The esophagus may also be involved. If the degen-ion ensues on a scirrhus, the involved tissue may be found con-ted and hardened in places and soft from colloid accumulation in ers.

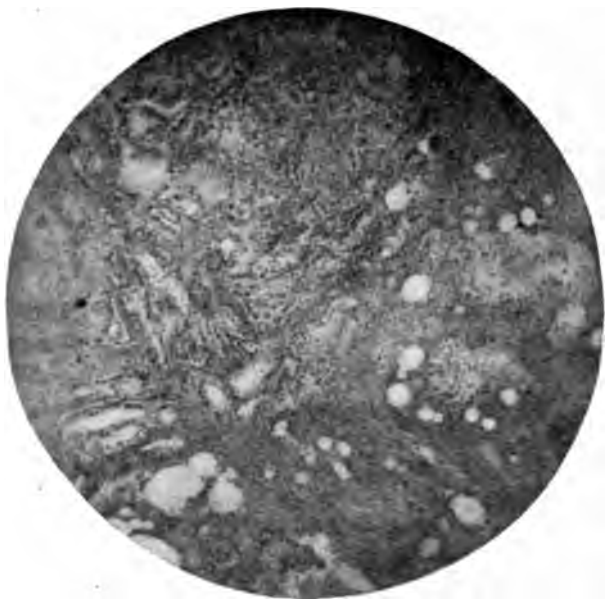


Fig. 92.—Photomicrograph of a section from a colloid carcinoma of he stomach. Note the groups of carcinoma cells and the areas of colloid degeneration. × 70.

Any variety of the above-mentioned types may be found present ne same specimen, and it may be difficult to say to just which type tumor primarily belonged. The scirrhous type is the most com-n. Brinton in 180 cases of cancer found the different distinguish-types—130 scirrhous, 32 medullary, 14 melanotic and 1 epithelioma. e melanotic form is generally the medullary blackened by blood-ment from frequent hemorrhages.

In a topographical way, two classes of growths may be designated:

those involving large areas of mucous membrane and which, in proportion, are rather definitely confined to the stomach (medullary), and those which involve relatively a small part of the mucosa, extending thickly in the walls and into the surrounding organs (the scirrhous and colloid). The distinction is not uniform clinically because of the combinations of types and differences encountered, but has a slight practical bearing on some points in the diagnosis.

Secondary cancerous growths take place by direct extension by continuity of tissue by way of adhesions or by metastasis. The latter are found most commonly in the lymphatic glands, routes of lymph-vessels, in the liver, peritoneum, omentum, intestines, gall-bladder and even in the pleura and lungs. The left cervical and inguinal lymphatic glands are often affected, and subcutaneous nodules may be observed near the navel. The liver is involved in about one-third of all cases. According to Brinton, metastasis was observed in about one-half of the cases. They are more common in the medullary and colloid cancers than in the scirrhous form. The swollen glands seen in these cases are generally due to cancerous deposits, but may be due to simple swelling adenitis from toxic irritation. Metastases in cancer occur by way of the lymph- and blood-currents—mostly by the lymph-vessels—and those in sarcoma practically by the blood-vessels alone. Numerous miliary metastases may be found in the pleura and peritoneum, closely simulating the finely scattered tubercles of tuberculosis.

SYMPTOMS.

In analyzing the symptoms of gastric cancer for the sake of completeness, it is desirable to describe them in a running order—the constitutional and gastric combined. Added to these are those due to the secondary growths.

Of first importance are the significant points in the history of these cases before they have presented themselves for diagnosis. This deals with a general consideration of the patient and particularly his gastric history in the past, the age, and subjective and the objective symptoms observed by the patient himself. Of great value in this connection is the discernment and understanding of the details of the patient's report, the knowledge of and the ability to correlate significant symptoms so that the important points are grasped and massed and the non-significant dropped out, and the deductive ability on the part of the history taker to analyze all gastric cases away from malignancy rather than take cases in the early visits too lightly only to find out later that more serious trouble had existed. It is well to suspect malignancy in all middle-aged and older persons who give a continuous

history of gastric disorder running over a length of time and in whom the intervals of relief have been absent or only very transitory. With the probability of the presence of a cancer first in mind, no interference is subsequently caused in the making of diagnoses of the benign conditions, but little time is lost, and more cases of gastric cancer would be diagnosed earlier. Details of this will be taken up in connection with the diagnosis of early gastric carcinoma, and are also found later in this chapter and in Chapter IV.

Among the subjective symptoms of first order is the sudden beginning of the affection in a person who has always been quite free from digestive disturbance or distress, or one who has had only very minor or very transitory disorder in the past. Added to this is an accompanying progressive failing in general nutrition and physical strength. Von Leube correctly states that there is full cause to think of gastric cancer when the gastric affection occurs in a person who for fifty or sixty years had a stomach which did not require care and could endure all kinds of foods. The reverse of this, in the way of constantly present dyspeptic disturbance, is observed in about one-fourth of all cancer cases, and about two-thirds give what may be termed a very transitory dyspeptic history.

SEPARATE SYMPTOMS AND DIAGNOSIS.

Anorexia.—Appetite is frequently diminished while thirst is increased. Anorexia, according to Brinton, was observed in 85 per cent. of the cases. In this, the aversion for meats is characteristic but not always present, for often when this aversion is apparently present there exists also the inaptitude for all foods of a very solid nature. The anorexia may be due to the fear of distress after eating, or it may be central in its nature. I observed one case of cancer of the lesser curvature and another of the lower part of the pylorus and body of the stomach in which the desire for foods had been increased above normal. In both of these "longings" for highly spiced and irregular articles of diet existed. However, the rule is anorexia, often profound and accumulating, for all foods, excepting occasionally those of a fluid nature. An excessive thirst is common when pyloric stenosis exists.

Eructation.—This is a late symptom, and is due to gas-formation from gastric stagnation and fermentation. In the scirrhous cases the gases are usually odorless until very late; in the medullary and colloid they are inclined to have an exceedingly bad smell and taste from very early in the case. These may be caused by decomposition of the neoplasm, and, of course, when stagnation exists, from the excess of organic acids and putrefaction present in the organ.

Pain, Pressure and Distress.—In the beginning of the affection, pressure and other difficult-to-describe post-meal distress may exist. In the course of time, actual pain ensues on top of this, pains which not only follow the taking of meals but which are more or less constant. Strangely enough, all of these symptoms may be altogether absent; although it should be stated that some degree of pain is a most constant symptom. I recently observed a case of marked carcinoma involvement in a physician whose first knowledge that his failing health was due to a gastric disorder came when he felt a large and very easily palpable mass in his epigastrium. There had been no post-meal pain or discomfort, just slight eructation, although the chemical and bacteriological examination of his stomach contents showed a well-advanced involvement. The pains may be in the gastric region, right hypochondrium, sternal, low in the abdomen, or in the back. In cardia affections it is often in the shoulder and thorax. It is described commonly as of a lancinating character, but may be burning, gnawing or drawing. It usually begins early, and rapidly intensifies to the exclusion of all other subjective symptoms. Whether the stomach is normally empty, after vomiting, or full of food, it is uniformly present, differing in that way from that due to gastric ulcer. When ulceration or perigastric inflammation exists, it is more severe. Late in a case, the subjective appreciation of it may be markedly dulled, or require only very simple measures to control it. In a number of cases the pain is intensified during the night.

Vomiting.—Vomiting is a frequent but by no means a constant symptom. It is rarely present in the early cases. In these, nausea and slight regurgitation of bad-tasting, sour fluids may be complained of, although even these may be absent until very late or not present at all. In the involvements of the pylorus it is quite constantly existent, and then is due more to the stenosis causing obstruction to the exit of foods and excessive accumulation and fermentation than to the mere presence of the malignant growth itself. The vomiting at these times is of the collective type, containing undigested foods which had been swallowed one or two days before, with a large quantity of offensive fluid in which are found numerous micro-organisms, sarcinæ, yeast-cells, the organic acids, mucus and sometimes changed blood and tumor fragments. Vomiting is found most frequently when the orifices are involved. Even here it may be late, while vomiting due to gastric ulcer is an early and reliable symptom. Vomiting is less frequently present when only the posterior wall, the curvatures, or the body of the stomach is affected. It may be present, however, and if so it is generally independent of the taking of foods, or occurs

right after the ingestion of them for collecting reasons. In late cases, from admixture with blood from an ulcerating surface, the vomitus has the well-known coffee-ground appearance. In these cases the vomitus is blackish, a dark red-brown, or even of a greenish tinge, in which case it is very thin. Vomiting is a symptom found in the course of about four-fifths of all cases.

Fig. 93.—Graduate of stomach contents aspirated from an advanced case of carcinoma of the body of the stomach showing its characteristic layers. The lower layer looks relatively small in amount because it had packed down from standing for twelve hours. In this case, at the end of a day in which but little food had been taken by the patient and four hours after a meal consisting of about 200 grains of buttered bread and a cup of tea, the aspirated quantity measured over 800 cubic centimeters of a coffee and milk colored, strongly butyric acid smelling fluid. There was no HCl or enzymes present, nearly 2 per cent. of lactic acid and an abundance of Boas-Oppler bacilli.

A characteristic feature of the stomach contents of stagnation due to pyloric stenosis is the fact that when left standing it separates into three distinct layers. The upper zone consists mostly of mucus, air and floating detritus; the middle of rather a less opaque, darker, coffee-and-milk-colored fluid; and the lower lighter in color, like the top, and consisting of settled food detritus.

Hemorrhage.—Vomiting of blood is observed in about one-half of the cases, and is due to transudation from a soft growth or bleeding

from an eroding ulcer on the surface of the malignant mass. The blood may be ejected in a clear state, large or small in quantity. It is usually mixed with the contents of the stomach and much altered in color, or it may have been so changed as to present no color at all (occult blood). When once established, the bleeding is usually quite constant, while that of ulcer is intermittent and can usually be controlled and stopped by appropriate treatment. Melena is not so constant a symptom as in ulcer; this is due to there being less hemorrhage as a rule, the common existence of obstruction of the pylorus, and the marked alteration and perhaps digestion and absorption of the blood before it is excreted in the feces. Vomiting of a large amount of blood may cause the quick fatal ending of a case.

Constipation.—The bowel movements are variable, although constipation is the rule. According to Ewald, only 4 or 5 per cent. of the cases have regular movements. On the other hand Fr. Müller observed diarrheic conditions present in 35 per cent. of all cases. This to me is a larger number than I have observed excepting in those nearing death. The constipation may alternate with a diarrhea caused by the catarrhal state of the intestinal mucosa due to decomposed foods from the stomach, or from the irritation incident to the presence of long-retained hard scybala in the lower colon and rectum, or from secondary colonic ulceration. It frequently means the beginning of the end of a case (colliquative diarrhea), and may be the proximate cause of death.

Fever.—In addition to the cases in which fever is due to an intercurrent affection, accompanying a resulting phlebitis, peritonitis, or pulmonary complications, there are cases of gastric cancer accompanied by prolonged fever. The cause of this is difficult to understand, although it is probably due to continuous absorption from an ulcered surface, to an effect on the heat centers by the carcinoma toxins, or to actual inflammation about the neoplasm. It usually is observed late, and death may occur shortly after its onset. When observed, it is generally continuous, although it may be of the intermittent form like a malaria. Several years ago I saw a case in which the presence of fever first presented a case of cancer of the stomach for medical observation. The fever causes an aggravation of the condition, and further weakens the patient through systemic intoxication and debility. These latter are also responsible for the comatose state sometimes seen just before the end.

Condition of the Blood.—A decrease in the number of red blood-cells and hemoglobin is common. The cells may fall to 1,500,000 and the hemoglobin to 50 per cent. The reduction in the number of red

cells rarely falls to as low as that of pernicious anemia, a point of some diagnostic value. The leucocytes may be increased to 15,000, rarely more. Schneyer[3] stated that the usual increase in the number of leucocytes found during digestion is absent in all cancer cases. This, in my opinion, is observed almost always as a late condition, and is due to the loss of the normal digestive functions of the stomach. It is therefore of little diagnostic significance in early cases, since on several occasions I have found it to be absent all the way through the course of cases. Occasionally when either an ulceration or reactive inflammation is marked, a higher than normal polymorphonuclear count is noted.

Condition of the Urine.—On account of deficient taking of foods and vomiting and long retention in the stomach, the urine is diminished in quantity and concentrated. The amount of chlorides may be diminished, and the excretion of nitrogen increased beyond the food values. A peptonuria may be observed from absorption by way of adhesions into the general circulation into organs not directly connected with the portal system of veins, or it may be by way of an ulcered surface, which to me seems doubtful. High indicanuric urines are common, particularly when peritoneal carcinosis is present.

Edema.—An initial malleolar edema may be seen for a short time in an early case. Usually, however, it is found only in the late cases, when it is more of an anasarca with or without the presence of ascites. The pleura and pericardium may also contain fluid which is not caused by metastasis in them. The dropsied development is due to the reduced condition of the body, the anemia, and the intoxication. General itching of the skin, like that found in diabetes, may be present.

Cachexia.—Cancer always leads to cachexia, which is most pronounced when the emaciation is well advanced. This begins as a faint lemon-yellowish tint, which darkens into a beeswax color later in the case. In the beginning, care must be taken not to confound the color with a slight hepatogenous jaundice. When the waxy, tanned color is present, this is not so liable to occur. To me, in a well-advanced case, the color of cancer cachexia is quite specific of the disease, although it must be said to very closely simulate that found in other severe debilitating illnesses—such as Addison's disease, hepatic cirrhosis, cardiac affections and amyloid degeneration. Doubts about its presence may be so confusing as to make it of questionable value, and thus it might be considered of only relative importance as a single symptom of carcinoma. It is brought about by the anemia, the subnutrition, and the cancer toxemia.

—These occur commonly in adjacent and in remote al peritoneum, pleura, pericardium, left supraclavicular inal lymph-nodes, skin, etc. The liver is the most frequently olved.

Tumor.—The presence of a tumor in the gastric region added to the important other symptoms is confirmatory of cancer. It is the one reliable symptom of the group. Owing to the position, stomach tumors of the cardia, lesser curva and posterior wall are rarely felt unless they are of consider size. Those in the pylorus, anterior wall, and most of the greater rvature are readily felt when of some size. Inspection alone in an naciated subject may disclose its presence, when it will be seen as a fl tened mass raising the epigastrium (recumbent position). With tips of the fingers, a hard, nodulated body of varied size and shap is generally felt, although the mass may be felt somewhat soft, pe haps small, and occasionally smooth on the surface. The mass is usually not influenced by ordinary respiration unless adhesions with the liver exist, when it would move up and down. On deep inspiration a pyloric growth or those of the curvature without adhesions may descend slightly and can be held in the lowered position during expiration. The growth is usually high, near the median line, and approaching to the right or left costal margin. From its weight it may have dragged the pylorus downward until this is situated at the umbilicus, or even lower in the abdomen. It is accessible to palpation in 80 per cent. of the cases seen, and is usually observed after the third month of the disease. Examination by palpation is usually made with the patient lying down, drawing the knees up (close together) and separating them somewhat to relax the abdominal muscles still further. Diverting the patient's attention by conversation is also helpful in obtaining a soft abdomen. Of service sometimes in the doubtful cases is examination in a warm bath or under narcosis. Inflation of the stomach may be resorted to to bri tumor into reach or cause it to disappear when it is posterior the lesser curvature and the organ is low. In a very few cases ga diaphany may show the shadow of a tumor when it is in the ante wall or very general about the pyloric region.

DIFFERENTIAL DIAGNOSIS BETWEEN CANCER AND FALSE GASTRIC TUMORS.

	Tumor (Palpation).	*Percussion.*	*Inspection.*	*Upon Inflation of the Stomach.*
Cancer.	Uniformly hard, irregular or smooth; mass always present and with definite outlines.	Dull over growth.	Local bulging in epigastrium may be observed standing or lying down.	Made accessible or lost entirely according to the position of growth and degree of inflation.
Prolapse of left lobe of the liver.	Soft, shelving, smooth mass. No outline above, definite edge below. Usually not apparent on inspection, but may bulge the epigastrium slightly.	Continuation of liver dullness from thorax to liver edge.	May bulge slightly and over large area when lying down.	Not affected or made capable of palpation. Position not influenced.
Exposure and thickening of the abdominal aorta.	Very deep and vertical running swelling of small size and narrow which pulsates strongly. Close to the vertebral column. Can only be felt in a thin, relaxed abdomen and can be traced downward to the iliac bifurcation.	No change of percussion note.	Not observed. Diffuse epigastric pulsation may be noted.	Usually lost entirely in the epigastrium or impulse becomes more diffuse.
Localized contraction of rectus muscle.	Resistance, with lateral edges running transversely about one and one-half inches and vertically about three. Smooth surface. Not always present, returning and disappearing under examination.	No change of percussion note.	Nothing apparent.	Not affected unless distention is much, when it may display increased resistance for the time being.
Gastric adhesions, and induration of chronic ulcer.	Resistance indefinite. Usually at the lesser curvature or pylorus. Usually very small and is not progressive in development. Does not show the characteristics of above.	No change of percussion note.	Nothing apparent.	Usually masked altogether, returning when gas has left the stomach.

DEFINITE SYMPTOMS PRODUCED BY THE LOCATION OF THE TUMOR.

Cardia, Pylorus and Body of the Stomach.

Cardia.—From the obstruction of the malignant growth (stenosing the orifice and interfering with the normal resiliency of the opening), dysphagia is common and is a cardinal symptom. The first notice of this is usually in a delay and in the labor necessary to swallow solid foods. This is accompanied w a fullness and distress in the lower sternal region which continues i il the food has passed through the cardia. The patient eats slowly, nconsciously chews his foods finer, and stops eating at intervals dur ıg the meal. He then begins to employ fluids to wash the food from the gullet, and eschews the solid forms of food (meats, hard vegetables, etc.). This stenosis grows more pronounced until finally he employs only the fluid foods. This is followed by the pitiful stage of not being able to swallow anything. When this point is reached, the food collects in the esophagus, when, after straining and retching, the patient regurgitates it. With the ejected food is generally found mucus and perhaps blood. At other times than when eating a burning pain exists in the inner cardiac region or back, and more or less clear fluid may be ejected from the gullet, especially at night when recumbent. The stomach at this late stage of stenosis usually is considerably smaller than normal, differing in this way from the clinical picture of dilated stomach ordinarily observed in cancer of the pylorus and pyloric region. About one-fifth of the stomach cancers are found at the cardiac end of that viscus.

The diagnosis is usually made by the obstruction offered to the passage of the stomach-tube or bougie, the same occurring at the point down from the incisors which would correspond to the cardia in the height of the patient. When the condition is found, further examination should be made with different sized olives until the one which passes through is obtained. This gives the degree of stenosis, while the grasping of the shoulders of the withdrawing olive by the growth will give its degree of resistance. Too much force in pas a stenosis should not be employed, because of the danger of injury and the liability to subsequent periesophageal in which are very liable to be fatal. In late cases or when the irregular in shape the stenosis may not permit of the instruments.

With the use of a tube and a suction ball, additional facts pertaining to the presence of malignancy are often obtained. These are found in detached particles of the malignant growths; blood, which usually is altered and fetid but may be fresh and clear (in the latter event it is not so sure a sign); pus and mucus; and long-retained, undigested foods, without the admixed presence of hydrochloric acid or the enzymes of the stomach. In the obtaining of these the instillation of 20 or 30 cubic centimeters of water through the tube when it is *in situ* and then aspirating this is helpful in obtaining more significant results.

The use of the X-ray is very valuable in these cases. If a mixture of rather coarsely cut-up meat (about 2 ounces) is mixed with one of the bismuth salts (about ½ ounce) and the entire quantity swallowed, a radiograph will usually show a long, sausage-shaped shadow, the lower pole of which is at the cardia. This meat and bismuth mass or other mixtures of bismuth must be swallowed quickly and the exposure made at once with the patient in the recumbent or upright position and the plate under the thorax on the back of the person. Another very valuable and perfect measure (although hardly necessary in most cases) is the use of the esophagoscope, by means of which the neoplasm can often be seen.

A sign of some value is a delay of from ten to twenty or more seconds in the cardia squirting sound following deglutition, and which is heard normally at the cardia in seven seconds. This is tested for by having the patient swallow water, timing the moment of the raise of the larynx, and then, with the bell of the stethoscope at the left of the ensiform, noting when the fluid passes into the stomach. Too much dependence should not be placed upon delays in this second sound of deglutition, because it may be normal even in moderate stenosis, and much lengthened in some persons who are perfectly well. Then, again, it may not be heard at all, or be confused with sounds generated within the stomach. It is sometimes most audible between the spinous process and just inside of the angle of the left scapula.

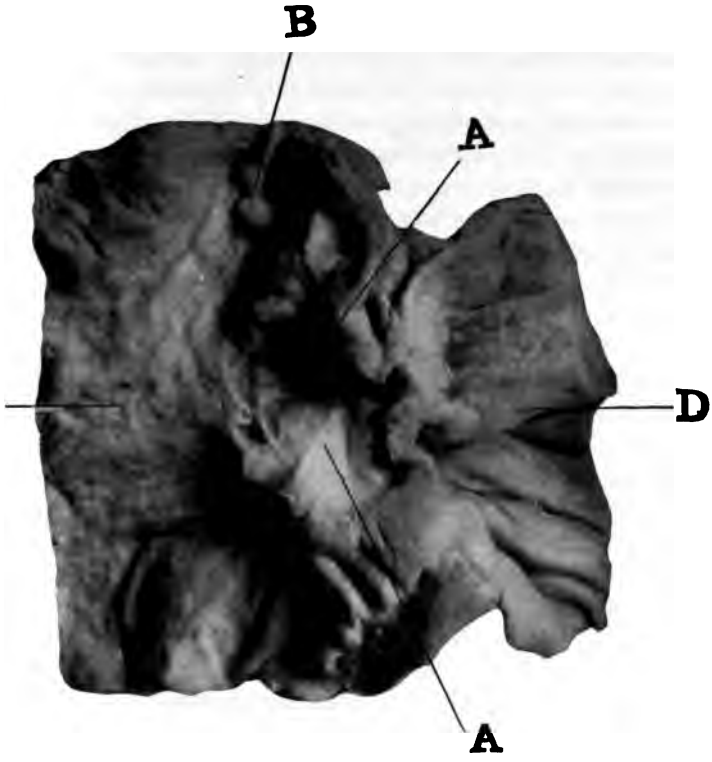
The existence of a left-sided pleuritis may be of some diagnostic significance in carcinoma of the lesser curvature or cardia. If no other etiological factor for the existence of a left-sided pleurisy or left base consolidation of irregular type (usually a triangular consolidation extending from the vertebral column to the midaxillary line) can be demonstrated, and other symptoms point to the existence of gastric carcinoma, then a suspicion can be entertained that these are the result or due to the presence of malignant disease, usually at the cardia.

Pylorus.—Three-fifths of all gastric cancers occupy the pyloric region. At this site, uncovered in the abdomen as it is, the tumor is usually plainly palpable. When the stomach is atonic, the giving of water draws the pylorus down and renders it more accessible for examination. The same rule holds good in the case of distention from foods, although in my experience too vigorous inflation with gas may mask the results obtained from both palpation and inspection. When the organ is depressed (ptosis), the pylorus may be much lower than just below the liver in the median line, which is its most frequent position.

Fig. 94.—Photomicrograph of a section of a carcinoma of the stomach involving mainly the pylorus, showing large collections of carcinoma cells between the muscle bundles and also, as the center of the picture shows, the actual infiltration of the musculature itself. × 70.

Characteristic of growths in the region of the pylorus is the vomiting and the peculiar stomach contents, both of which have been described. These are due to mechanical obstruction to the exit of chyme and its accumulation in the stomach. It may, however, be due to stiffening of the pyloric region from carcinomatous infiltration of the muscle bundles at that site, and, as I have seen on two occasions when the primary growth was in the posterior wall, there would be no actual stenosis of the pylorus itself. In these instances the entire lumen of the stomach is contracted at that point, and this is equivalent to

PLATE XLIV.



ft glandular carcinoma of the stomach directly at the pylorus. The
›arely admitted the passage of the tip of the finger at post mortem.
›mach contained 260 c.c. of so-called "carcinoma juice." *A*, Car-
. *B*, Secondary carcinoma nodules. *C*, Stomach. *D*, Duodenum.

[redacted]

stenosis at the valve itself. The vomitus is generally large in amount, running in one of my cases to 1650 cubic centimeters at a time.

Stagnation of foods is a common symptom. This is due to the obstruction, muscle paresis accompanying the atrophy, and the absence of the hydrochloric-enzymotic function. Foods from the day before are often found present in the stomach. And such articles as fruit, prune or raisin skins and other difficult to disintegrate substances may remain present in the organ for two days or more. Many times in these cases pieces of food will obstruct the eyes of a tube so as to render it difficult to empty the stomach by lavage. The stomach is usually much enlarged on physical examination, and visible peristaltic movements of the stomach are important symptoms.

Stomach Walls.—In growths of the stomach proper, the lesser curvature is the most commonly affected. After these in clinical order come those of the stomach as a whole, the greater curvature, the posterior wall, and finally the anterior wall. As the growth encroaches upon the orifices, the clinical picture generally changes. In those of the posterior wall a tumor may not be evident from without, and still the gastric contents be that of a true pyloric stenosis. Evident tumors are liable to be to the left of the median line, and the stomach may be found contracted by diffuse infiltration; in these instances the chamber is small and its contents little. In practically all of the wall affections, food stagnation is also present, but the food is liable to be in finer particles than in those of the pylorus. When there is a very extensive involvement of the walls the term "leather-bottle stomach" has been applied—a not inapt descriptive term. The esophagus and the duodenum are sometimes involved in these diffuse forms. Tumors of the lesser curvature are not palpable (unless the stomach is low), while those in the anterior wall and greater curvature are quite evident.

GASTRIC ANALYSIS.

Hydrochloric Acid.—Diagnosis of cancer is made from the above-enumerated symptoms and the examination of the gastric contents. In addition to the important results obtained in the examination of gastric contents in the way of acquiring knowledge of the dynamic power of the organ, most important are the chemical, bacteriological, and pathological findings. In fact, it may be said that these latter not only confirm but primarily make most of our diagnoses for us. Unfortunate enough it is that the specific trilogy of laboratory findings in gastric cancer—absence of HCl, excessive presence of lactic acid, and large numbers of Boas-Oppler bacillus—usually means a late case, and

that some positive and always sure means has not been found to make possible an early diagnosis in cases of cancer. Leaving out of consideration the cardiac growths and those which occur under a connective-tissue formation—like carcinomatous degeneration of a chronic ulcer—our knowledge to-day and my own belief are about as follows:

The common absence of hydrochloric acid in gastric cancer was definitely disclosed by Van den Valden in 1879. In a general way it may be said to be absent in practically all of the cases of true gastric cancer late in the disease. In the beginning of the disease in a previously healthy stomach, and for some time during its early progress, it may be found, but, important to note, usually in lower and diminishing quantities as time goes on. In the beginning of pyloric cancer, toxic discharge from the cancer may irritate the stomach surface so that the acid content is actually increased. In the end this same toxin destroys the secreting cells, causing a diminution and finally a cessation of the acid-enzymotic secretion. Added to this then come the bacteria and organic acids and irritations from decomposing foods to further complete the destruction. While the absence of the hydrochloric acid in itself is not indicative of cancer (atrophic gastritis, anachlorhydria), in patients who have reached late middle life and who present other suggestive signs of malignant affection it is a valuable symptom. With the loss of the acid, the proenzyme is also found wanting. It has recently been suggested that malignant disease of the fundus and body may be differentiated from that of the pylorus by a quicker loss of the acid than that of the enzymes, pepsin (and chymosin) being used to designate this.

Graham and Guthrie, who studied the gastric findings in 150 cases of gastric cancer at Mayo's clinic, reported the following: Of the cases of gastric cancer free hydrochloric acid was absent in only 80, lactic acid was present in but 64, and food remnants in 63. To turn from figures to comments, it is seen that while free hydrochloric acid is rarely present with advanced gastric carcinoma, in the earlier cases the test-meal may avail us little or nothing. Decided food remnants are of greater significance as a surgical indication than the acid percentages. On the other hand, there are a few cases in which the subjective symptoms are indefinite, and where the test-meal throws the first light upon the real pathological condition present. And so gastric analysis, like so many other of our chemical tests, must not be relied upon to the exclusion of clinical factors, but is to be accepted only in connection with careful anamnesis and physical examination.

Organic Acids.—Considerably more important than the absence of hydrochloric acid is the presence of abnormal amounts of lactic acid.

While lactic acid is present in many normal stomachs (from milk, meats, fish and milk foods), it is only so in very small quantities. In these instances, and in some of the gastritides in which the digestion is tardy and the gastric secretion somewhat low, the amount is far below giving reactions with Uffelmann's reagent or Simon's modification of Kelling's test. The formation of lactic acid in the stomach is pathological, and when it occurs in easily recognizable quantities it is strongly suggestive of cancer.

The method of Boas, to whom much credit is due in the develop-

Fig. 95.—Photomicrograph of a piece of tissue which was found in the wash water from a case of medullary carcinoma. The specimen contains practically only carcinoma cells and was observed as a colorless shred almost indistinguishable in the water. Stained with eosin and hematoxylin. × 105.

ment of this subject, is to employ a test-meal which is free from lactic acid, and when this acid is found in the return, obviously it had been generated in the stomach. For this purpose he employs a soup made of Knorr's oatmeal ingested after a thorough washing of the stomach. One hour afterward the gastric contents are obtained and examined for lactic acid by the Boas method, Uffelmann's test or the ferric chloride solution (Kelling). It must be said that to make this test of more positive value, milk should not be allowed to be taken during the twenty-four hours previous to the ingestion of the oatmeal.

The formation of lactic acid is due to fermentation within the stomach, conditioned through the absence of hydrochloric acid and the stagnation of food. Added to this is most probably the influence of the lactic acid bacilli on the gastric contents, and the marked diminution of the gastric enzyme.

While lactic acid in excessive amounts is found in about 90 per cent. of gastric cancer cases, it is also present in a few of the non-malignant affections of the pylorus (cicatricial contractions, perigastric adhesions, hypertrophic stenosis, chronic ulcer of the aged) where obstruction and fermentation have permitted of organic acid formation. It may also be present under the relative conditions of marked atonia and absence of gastric secretion (enterogastric and gastric atrophy, pernicious anemia, and passive congestion). In early cases of cancer, and in those forms in which the cancer is practically outside of the organ or affecting the mucosa only slightly (ulcus carcinomatosum, or small surface growths), the lactic acid formation may not be observed or only very late in the disease. Thus it is that like, with all laboratory tests, its value is in the positive way, and its absence does not necessarily exclude cancer.

Tumor Particles and Organic Findings.—The one pathognomonic symptom of gastric cancer (other than its observation by exploratory incision, or to view the growth through the gastroscope) is the finding of particles of tumor in the vomitus or removed gastric contents.

These fragments, which are not commonly found, are usually encountered quite accidentally. Search for them should always be made in test-meals and lavage water from all suspicious cases. In rare instances they may be found before the tumor is palpable from without, but generally they are only obtained late in a case after the other symptoms are quite conclusive. They are usually seen as a film or quite colorless piece of tissue and thus may easily escape observation, or they may be found reddish or brownish in color from blood in their substance. I would suggest the more universal employment of the practice to run all wash waters through a very fine metal sieve so as to collect all particles from the stomach whatever the diagnosis of the case may be. In this way, no doubt, more cancer particles will be found. For this, and for the purpose of collecting particles of food from the stagnant stomach, I would advise the use of the sifting pail described in Chapter VIII.

In some cases the diagnosis may be made by the finding of smaller pieces of cancer tissue in the lavage water consisting essentially of a conglomeration of a few cells. It is probable that carcinoma cells are commonly shed in most cases, but one is beset with much difficulty in collecting them. Then there is the great question in the examinations

as to whether suspicious cells that are seen are really carcinoma cells or only particles of vegetable tissue consisting of small round cells. It is because of this and the free nuclei present normally from free cells in all stomachs that render the clinical value of these examinations very doubtful. On a number of occasions I have centrifuged wash water in the search for them when I believed they were most probably present, and other materials (fine food particles, mucus, bacteria, etc.) obscured the fields so that it was quite impossible to be sure that what looked like suspicious cells were positively elements from a cancer. Blood and pus, however, commonly present in cancer cases, are important and valuable findings. Blood is particularly important, especially when it is constantly found in the lavage water. It represents leakage from the growth surface. It is only rarely found and then interruptedly in cases of simple ulcer which are well enough to be lavaged. Trauma from the tube may cause its presence (particularly under the influence of retching and straining), but this can usually be obviated or plainly accounted for. The pus usually is not fetid, and is due to ulcerous destruction of the cancer surface.

The microscopic examination of stagnant gastric contents in cases of cancer is most important. Naturally, food particles, especially meats, are quite common. And when taking into consideration the time of their ingestion, the appearance of them in quantity is confirmatory of stagnation. The giving of raisins the evening before and observing if the skins are present in the morning stomach, as shown by Mayo, is a simple and valuable method of noting stagnation. Yeast and molds are generally absent, while the presence of cocci, either staphylococci, streptococci, or diplococci, makes a common picture. These, of course, are suggestive of ulceration, a condition, in my opinion, which occurs early in many gastric cancers.

A frequent microscopic picture of stomach contents is the presence of large numbers of large-sized immovable organisms called the Boas-Oppler bacilli. They are seen as long, rod-shaped bacilli, found in running formations, or they may be seen detached from one another and lying in all directions like small sticks, or they may join each other in a zigzag order. In length they are from 6 to 8 μ and are about 1 μ in thickness. They are anaërobic and occur without the formation of spores. When viewed under a cross-light, plain or when but slightly stained, they present a shiny, hyaline appearance. The bacilli are capable of coagulating milk and generating lactic acid from various sugars, and may therefore, according to Boas,[4] be looked upon as the main or one of the inciting factors of lactic-acid formation in the stomach. They are quite constantly present in carcinoma when lactic acid is present in excessive amounts, and are almost always

absent in any amounts in the non-malignant affections. The organism is readily stained with the usual aniline stains and is Gram-positive.

When lactic acid is found, the lactic acid bacillus is also present. In doubtful lactic acid reactions its presence is of some significance. The presence of the lactic acid formers—lactic acid bacilli and the Boas-Oppler—is not as valuable in the clinical way as the presence of lactic acid itself. I have observed cases of cancer where it was impossible to be sure that these organisms did or did not exist and still lactic acid was present in easily determinable quantities.

A test of the gastric filtrate for carcinoma of the stomach has recently been advanced by Neubauer and Fischer. The principles

Fig. 96.—Photomicrograph of a drop of gastric content aspirated from a case of marked carcinoma ventriculi showing the Boas-Oppler bacilli. Stained with aqueous methylene-blue. × 700.

upon which it is based are, that the digestion of proteins proceeds further in a carcinomatous stomach than in a normal one, due to the presence of an enzyme from the carcinoma which is analogous to trypsin in its action, and that the amino-acid tryptophan in peptide combination as glycyl tryptophan cannot be digested by pepsin and does not give a color with bromine; when the tryptophan is split by a tryptic ferment (such as the one from a carcinoma) a reddish color results when the bromine vapor is added.

The test is performed by first thoroughly purging the patient, the giving of an Ewald test-meal the next afternoon which is extracted in three-quarters of an hour, testing same first for the presence of blood, bile and amylopsin, and if these are negative, then filtering the return and testing for tryptophan with bromine vapor, and, if this also is negative, proceeding as follows: 10 cubic centimeters of the filtrate are added to 2 cubic centimeters of glycyl tryptophan solution, the mixture is covered with a layer of toluol and placed in an incubator for twenty-four hours at 37° C. At the end of this time about 3 cubic centimeters are removed with a pipette, put in a test-tube, a few drops of a 3-per-cent. solution of acetic acid are added; and the bromine vapor gently blown down the side of the test-tube in small amounts at a time so as not to color the filtrate with it too quickly. If tryptophan is present, a color develops which varies from a light pink to a deep red-violet and the test is positive.

Although enough time has not elapsed to draw much definite conclusion as to the value of this test, the author believes that it will prove to be a more valuable one for cases of gastric cancer than the Solomon test. Up to the present, I have not met with failure in obtaining a positive result in the last 14 cases of gastric carcinoma I have seen, in 5 of which definite amounts of free hydrochloric acid were present and no distinct evidences of stagnation, large amounts of lactic acid, Boas-Oppler bacilli or blood were present. Great care is necessary in the making of the test that certain influencing facts are eliminated. Tryptophan may be present in normal stomachs; therefore, it is necessary to test the filtrate with the bromine vapor before the test is instituted. The presence of blood and regurgitated pancreatic juice must also be eliminated, because the first contains a proteolytic ferment which can split the peptide, and the second the ferment trypsin itself; therefore, the necessity of the chemical tests to note the presence of occult blood, and the macroscopic or Gmelin test for bile, and the hydrated starch test for amylopsin. Neubauer and Fischer state that 0.36 per cent. of hydrochloric acid in the stomach will render the test negative; therefore, if more than this amount of the acid is present, the filtrate from that test-meal cannot be used and another test-meal should be extracted with which an alkali was given at the time of ingestion. Lyle and Kober advise care in drawing negative conclusions when the acidity is over 12 or 15 degrees, and also that in all instances the hydrochloric acid acidity of the filtrate should be neutralized immediately after extraction with magnesia usta; the author has used a normal solution of sodium hydrate for this purpose and found it satisfactory, litmus papers being used as indicators.

Lastly and of much importance in diagnosis is the use of the X-rays in noting irregularity in stomach outline in localized areas usually at the pylorus and the lesser curvature (in which locality the investigations of Peterson and Colmers show that a carcinoma displays a marked tendency to extend within the stomach wall itself). According to Holzknecht, gastric tumors indicate their presence in the skiagraphic picture in one or more of the following three ways: (1) They cause the appearance of what look like empty spaces or defects in the current of the mass in the stomach; (2) they cause the appearance of abnormal boundaries of the stomach mass; (3) they produce irregularities of peristalsis. Kuttner doubts very much whether X-ray investigation provides any information that cannot be determined by other means of investigation. In the main, up to very recent times with the slow types of generators used, this was true. But in the future this will not be so, for there is much of significant confirmatory diagnostic value in the sharp pictures that are now possible to be made. Still, I wish to caution against making diagnoses from one or two plates alone without sufficient clinical data to substantiate them. It is now my practice to make at least three sets of plates (one of entire stomach and one of the pyloric region alone), on three different occasions of about four-day intervals, and then compare all of these to note if the findings observed in the first set are duplicated in the rest. By this method there is much valuable information to be gained by the X-ray method of examination, and the dangers of mistakes in diagnosis are minimized to almost *nil.*

DIFFERENTIAL DIAGNOSIS.

The diagnosis of moderately advanced gastric cancer resolves itself into the diagnosis of the attachment of a palpable tumor (whether gastric or not), whether the mass is malignant or benign, and between cancer and other gastric diseases.

The diagnosis between cancer and false tumors has been described (page 589). Whether an existing tumor belongs to the stomach proper, and if so to which portion, or to the surrounding organs is not always easy. Clinical points on this are offered in the following list:—

The subject-matter pertaining to benign tumors is treated in Chapter XXIII, page 624. It may be said that as a class they are conditions not accompanied with illness, and death is rarely due to them excepting possibly in an indirect way. They are uncommon affections and are rarely diagnosed during life. Gall-bladder conditions, thickenings in the stomach and adhesions about the pylorus may

	Inspection.	*Percussion.*	*Palpation.*	*On Inflation of Stomach.*	*On Inflation of Intestines.*
1. Stomach. Pylorus.	Commonly observed in epigastrium in or near the median line. Circumscribed.	Dull.	Easily felt.	Moves to right and downward.	Moves upward.
Anterior wall and greater curvature.	Usually prominent, especially when stomach is distended. Circumscribed.	Dull.	Easily felt.	Broader and becomes less distinct at periphery.	Moves upward.
Lesser curvature.	Not observable.	Questionable.	Not felt.	Disappears.	Moves upward.
Cardia.	Not observable.	No change.	Not felt.	No change; cannot be observed by physical methods.	Moves upward.
2. Liver and gall-bladder	Indistinct general fullness, or not observed.	Dull. Gall-bladder growths very questionable.	Easily felt.	Entire organ lifts, protruding the edge.	Edge moves upward. Gall-bladder tumors push forward.
3. Spleen.	Observed when very large.	Dull in abdomen.	Easily felt.	Moves to left and forward.	Moves upward and to left.
4. Pancreas.	Rarely observable, and only under extreme emaciation.	No change.	Indistinct and difficult to feel.	Disappears.	Usually masked by the colonic distention.
5. Colon.	Rarely observable and only when quite large in an emaciated abdomen.	When large, dull. When small, no change.	If of some size can be felt.	Moves downward.	Becomes more prominent and remains stationary.
6. Kidneys.	Not apparent, even when quite large.	No change.	Not difficult to feel.	Obscured, unless low in the abdomen.	Disappears or becomes indistinct.
7. Great omentum.	Long, transverse, diffuse swelling in thin subjects (tuberculosis, cancer).	No change.	To be felt, usually as a rather deep resistance of some area.	Moves downward.	Moves downward.

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may be observed for a short period. The cases are usually som
chronic, and are not progressive in the downward way, either
in the stomach or generally in the body. Continued obse
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EARLY DIAGNOSIS OF GASTRIC CARCINOMA.

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For when the malignant growth is large enough to be easily diag
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interference merely hastens the case toward the fatal ending.
to what has already been said in the introduction of this vol
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to the clinical details of the subject, it is truly unfortunate
absolutely positive symptoms or methods of examination hav
found for early cancer of the stomach. While this is so, the
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have heretofore existed. In a close observation of this subje
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can be diagnosed in the early stages of the disease, and in t
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the longer presence of the meal in the stomach, the gastric

mimic a tumor. It is natural to understand that any formation which has existed for several years is against its being a cancer.

The main clinical work is concerned in the diagnoses between cancer and other gastric diseases of a pronounced nature. The following are those conditions that may be confounded with it and which may be found treated in more detail in the chapters on these diseases: Ulcer (particularly chronic); chronic gastritis (particularly atrophic); gastric ectasia; pyloric stenosis, acquired and congenital; stenosing hypertrophy of the pylorus; neurotic states of absent and lowered gastric secretion; severe forms of neurasthenia gastrica.

In ulcer the onset of symptoms is usually more acute and the pain more piercing and agonizing than that of cancer. The pain is usually intensified by the taking of meals, and relieved when the stomach is empty; in malignant disease the pains are not much increased by the presence of food in the stomach and is present all of the time in about the same severity. The tendency of the ulcer cases toward recovery makes the history of pain and that of hemorrhage of shorter duration. In chronic ulcer, however, the pain may continue over a long time. In these, hemorrhage and certainly continuous bleeding is quite uncommon. In acute ulcer the characteristic front and back pain areas are found, while in cancer the pains are more diffusely distributed. The tongue in ulcer is clean, while that of cancer is thickly furred. Ulcer patients usually are well nourished and fail in health and strength but very slowly or not at all, the appetite remains good, and no real aversion for food exists. The gastric findings of increased or normal amounts of hydrochloric acid and enzyme, very little or no stagnation of foods, no increase in the amounts of organic acids, no Boas-Oppler bacilli, also the prominent feature of hypermotility showing but little remains of a test-meal in a short time are suggestive of ulcer. Mucus is usually scant in the ulcer of the stomach and no tumor presents itself in the course of time.

Chronic Gastritis.—When this is of the atrophic degree, the finding of gastric cells are pathognomonic of chronic gastritis. The long history of dyspeptic disturbance with cause for its origin, the finding of much mucus in the test-meal, and the very chronic state of the illness are important. Most cases of chronic catarrh improve substantially under appropriate treatment and the local symptoms and the general health recover; in cancer this is not so. Actual pain and hemorrhage are practically not observed. Gastric digestion may be tardy, but marked stagnation of foods is rarely seen. Gastric secretion may be low, but the organic acids in excess are not observed and the fermentation organisms are absent or very few. Steady observa-

tion of a dubious case will usually clear up the diagnosis. Absence of tumor and the history of intermissions are also important points.

Gastric Ectasia.—This refers to the primary ectasias accompanying the benign affections of motility and secretion, and disturbed constitutional states of health (debility and blood dyscrasias). Also, to the secondary dilating effects on the stomach from pyloric spasms. The primary ectasias are diagnosable by a general consideration of the symptoms, the disturbed states of motility and secretion, the absence of the characteristic cancer symptoms, and the improvement in the condition under appropriate treatment. They are not (as a class) accompanied with actual loss of the gastric secretions, marked stagnation of foods, high degrees of fermentation in the stomach, very much loss of weight, hemorrhage, actual pain, etc. The pylorospasms and disturbed general states of health are diagnosable in their own individual ways.

Pyloric Stenosis, Acquired and Congenital.—In the acquired forms, a definite or suspicious history of past gastric ulcer is common. After this there usually follows a more or less mild run of gastric disturbance of the subjective kind. Hypochlorhydria is common, but an achlorhydria with lactic acid formation may exist when cicatricial contraction or binding perigastric adhesions have obstructed the pyloric region for a long time. The rapidly progressive history of cancer is absent, and the case is of the chronic order. Tumors are rarely or only very questionably felt; dilatation, stagnation of food, and fermentation are only moderate, and hemorrhage is uncommon. In the congenital forms the history of disturbance in early life is valuable.

Hypertrophic Stenosis of the Pylorus.—This is a long-standing affection. It begins with a history of chronic gastritis, and the gastric dilatation is not marked or may be absent. The tumor is small, round and remains about the same size after once observed. In most cases, the presence of the tumor is first observed at autopsy. There is usually a history of alternating improvement and aggravation of the symptoms, although the history and gastric findings may be such as to make a diagnosis between this condition and cancer quite impossible. Late cases of unrelieved hypertrophic stenosis are particularly liable to be looked upon as cancerous. The condition is rarely met with.

Neurotic States of Absent or Lowered Gastric Secretion.—These are diagnosable by the presence of good states of general health, evident causes for their production, their alternating history, the absence of the characteristic gastric findings of pyloric stenosis and malignancy, and their quick and progressive improvement under

may be observed for a short period. The cases are usually som chronic, and are not progressive in the downward way, either l in the stomach or generally in the body. Continued obser usually clears, the diagnosis.

EARLY DIAGNOSIS OF GASTRIC CARCINOMA.

Surgery offers the one cure for stomach cancer, and succ this depends absolutely upon a diagnosis being made early in the For when the malignant growth is large enough to be easily diag involvement of organism is usually so great in extent that su interference merely hastens the case toward the fatal ending. A to what has already been said in the introduction of this volu Chapter XV and before in this one, and bringing consideration to the clinical details of the subject, it is truly unfortunate tl absolutely positive symptoms or methods of examination hav found for early cancer of the stomach. While this is so, the far from being settled even along the lines and by the mean have heretofore existed. In a close observation of this subjec ning over several years, I am convinced that a number of these can be diagnosed in the early stages of the disease, and in ti hope of cure in the surgical way. It may be said at the onse this is but rarely done to-day, and, further, that little can be ex along the lines of simple clinical observation of these cases, no in such general practice.

Three main facts appear to me as the *sine qua non* of accom ing an early diagnosis—first, a very close study of the labo findings and symptomatic details in all cases of gastric disease t

ularis. In its incipiency it is a small accumulation of cells, microscopic in size, causing no symptoms, either subjective or objective, and thus cannot be diagnosed. Insidiously, the cells rapidly multiply, accumulate in mass, and infiltrate tissues surrounding its point of onset. Clinical changes now ensue which are mostly objective and are but rarely observed by the patient. The diagnosis of this early stage of the disease can only be made from the laboratory findings of the gastric contents, to which it may be said that the anamnesis, the subjective and other objective symptoms are but rarely present, or, if so, are of no value in the specific way. Of course, a case must be seen early, and it must be remembered that in these cases we deal only with small clinical facts from a stomach at best but little known to us. Therefore it is that mistakes—mostly of omission—are liable to occur. The one significant keynote to lead us right in the work is the constant and progressive presence of abdominal findings in the contents taken from these stomachs. What are they?

Hemorrhage.—This is usually minute, is but rarely seen just so, and almost always occult. The expression method of extracting stomach contents must not be resorted to—it is too liable to be performed with trauma—but just a simple aspiration enough to overcome the force of gravity and to raise the meal through the tube. The bottle I have advanced serves well in this (Bassler[5]). If retching occurs during the process the presence of blood is of no value in the suggestive way, and should be discounted. We should not be anxious to empty the stomach at these times—from 10 to 20 cubic centimeters will do for these examinations. When a patient strains continually and under all conditions, and our suspicions of malignancy have been aroused in the case, a few meals may be extracted under nitrous oxide anesthesia. When blood is constantly present in meals extracted twice a week, be on your guard—it is more liable to be cancer than ulcer or of no significance. This symptom is found in about 20 per cent. of the early cases, and its absence does not necessarily exclude cancer, since in about half of the cases of this disease hemorrhage is not observed in the vomitus even late, but still in many of these, blood in small quantities is present in the stomach even from an early date. Examining the feces for blood in these early cases is of no value—the bleeding is too small in quantity, is absorbed, and thus not liable to give the reaction. Be careful not to permit the taking of meat foods for twenty-four hours preceding the taking of the test-meals. Washing the stomach before the meal is taken or the night before is inadvisable. Lavage of the empty stomach and examining the water for blood is not as good as the test-meal method—we want the longer presence of the meal in the stomach, the gastric

motility, the secretion and the normal increase of the blood within the stomach walls during digestion to encourage the bleeding from the free surface.

Pus Cells and Bacteria.—These come next in significance. Pus cells are not products of a normal stomach, and when they are found (excluding that which may be swallowed in sputum from the oral cavity or in the stomach in phlegmonous gastritis) they are indicative of ulceration. In my experience, they are often found in the stomachs of early cancer, proving, I believe, that ulceration is common in early malignant growths. They are not very numerous and rather difficult to discern in the amylum of test-meals. Lavage or extraction after ten minutes of normal saline instillations and centrifuging the return give the best results in the way of examination. The cells are sometimes found in dense conglomeration suggestive of a slough from an ulcerated surface. When these cells are regularly found, and particularly when red blood-cells are also present, be on your guard. With them, the bacterial flora of stomach contents are also increased. The cocci seen are either the staphylococci, streptococci, or diplococci. A common type of organism which may be markedly predominant is a streptobacillus. Loops from the test-meals inoculated into dextrose-bouillon suffice well for the bacterial examinations. The presence of what may be considered as increased numbers of micro-organisms can only be judged in the relative way. They are found in test-meals from non-malignant and normal stomachs, and their nature, whether suppurative or not, is difficult to detect. But when one type of them largely predominates, and is constantly present with blood and pus cells, they are of much significance. The Boas-Oppler are found late in cancer, but when noted in gradually increasing numbers are most suspicious.

The presence of minute particles of tumor tissue may be found and would be conclusive. These are very uncommon in early cases. The same may be said of loose tumor-cells, which are always doubtful in their nature—they resemble the free nuclei of digested normally free cells too closely for definite conclusions.

Hydrochloric Acid.—In the beginning of cancer in an otherwise healthy stomach the acid is mildly increased. This is due to irritation of the growth or its toxins, and is significant only when it is on the increase to a certain point and then takes on a steady fall downward after that. In some cases of cancer, and in ulcus carcinomatosum, it may be present to the very end. Then, again, non-benign stomachs (normal and pathological) vary so in their hydrochloric acid content and this secretion is influenced by so many conditions that its mere presence or absence at one time is of no value in this connection. The

practical point in the diagnostic way is its steady progress, either upward and then downward, or just downward (as the lateness of the case may be). Its rise upward is much more rapid than its subsequent early fall. When it begins to decline it starts slowly, accumulating as it comes downward, and runs an average fall of about four degrees in a week. In a suspicious case giving this excursion or downfall of total hydrochloric acid be on your guard lest a tumor be palpable in the epigastrium a month or two afterward. On the gastric enzymes so much reliance cannot be placed. The tests for their quantity are not so accurate as the acid, and they are liable to vary more than the HCl. As the hydrochloric acid runs low, the organic acids begin to appear. Tests for their beginning should be made, as well as for other evidences of fermentation and delayed motility. There is liable to be retardation in motility before actual dynamic obstruction exists. In other cases little delay is observed, although fermentation is liable to be increased above that of normal.

The Solomon test for gastric carcinoma is sometimes present in an early case. Its absence is not significant in the negative way since it may not be present even in a late condition. But it is a measure along with the others which may be helpful. The method consists of washing out the stomach the evening before and then on the following morning introducing 400 cubic centimeters of normal salt solution. This solution is removed after a short stay in the stomach, and tested for the presence of albumin and for the proportion of nitrogen. Marked turbidity with Esbach's reagent (picric acid) or the presence of more than 30 milligrams of nitrogen indicates the presence of carcinoma. The glycyl tryptophan should be applied to the filtrates of test-meals when the hydrochloric acid content is seen to be low and lactic acid is present. It should also be made use of in all cases of stomach disorder that do not respond to medical treatment, whatever the diagnosis, and particularly when the general health is failing.

Upon the history of heredity and subjective stomach symptoms little can be depended upon to assist us in the diagnostic way. "Family cancer," even more so than "family tuberculosis," is only of historical significance. Subjective symptoms, one and all, are of no value in the making of early diagnosis. As many if not more cases begin and progress markedly without any as with them. When they are present, the other benign and simple stomach conditions usually have more or the same in a more intense form. Marked anorexia, eructations, aversion to meats, pain, pressure, distress, vomiting, hematemesis, tumor, and so on are all late symptoms. Of some value, however, is loss of weight. This begins rather early in a slow way, and hastens later on. To record this best, it is advisable for the

patient to weigh stripped each morning after his bladder and rectum have been emptied and before he has partaken of food or drink. Careful observations and record should be kept in the matter of ounces of weight. A loss of a pound or more in a week is suspicious, and conclusive when the laboratory picture continues strongly suspicious. But when you are making these observations say nothing about dieting, excepting that the patient should continue eating and drinking as before. If you curtail normal persons' diet they are liable to lose in weight; and if you enlarge it, or suggest a total, or add a fluid or semi-solid diet—a common practice in treating digestive disorders—they may gain even in the face of a cancer present in the stomach. Above all, be watchful for the patients who have dieted themselves before they have come to you.

To tell patients in a soft, guarded way that they have a tuberculosis which can be cured, usually insures their hearty co-operation to bring this result about. Likewise in a suspicious case of carcinoma to inform them that a serious stomach disorder is imminent (you need not mention cancer) and that it is impossible to find out what it is unless they carry out your orders and report regularly for observation and examination usually awakens their attention and the fulfillment of your desires. Office visits are better in these observations than placing the patient in a hospital.

In patients who present themselves for treatment of gastric troubles, view with suspicion every case over forty years of age that does not show improvement after a course of treatment, whatever the diagnosis may be. Penzoldt rightfully advises that in these cases the diagnosis of cancer must either be made or refuted. At those ages, also, be on your guard with every case that gives a history of a "good stomach" before the present illness. In the diagnosis of early cancer laxity in thoroughness and expectant measures may be handmaids of disaster leading you to a disagreeable surprise. It should never be forgotten that it is the usual thing that when a tumor manifests its presence, the case is past redemption in a curative way. In favorable cases it takes from two to four weeks of steady observation to make a diagnosis or accumulate enough suspicion of early malignant disease of the stomach. In these, the careful examination of six or more test-meals are usually necessary. Then, with a reasonable certainty that cancer of the stomach exists, the case should be turned over to a surgeon for exploratory incision, and if the diagnosis has been confirmed, total extirpation of the diseased area, adhesions and metastases be performed. It may incidentally be remarked, that unless the abdomen is very fat, exploratory incision may be satisfactorily performed under one-tenth of 1-per-cent. solution of cocaine. Under this, when the

peritoneal cavity is entered, some care should be exercised not to impinge roughly on the parietal peritoneum (it is sensitive), nor should there be any tugging on the mesenteries when examining the stomach or intestines (patients are liable to vomit). In many instances with a little extra care and patience the examination can be made most satisfactorily under this local anesthesia, the posterior wall of the stomach can be explored, and if needs be the entire hand put into the peritoneal cavity so as to reach some distance beyond the incision of entrance. Patients will submit to an exploratory incision under cocaine, and be persistent against operation when a general anesthetic is intended to be used. Usually about an ounce of the cocaine solution is employed at these times, representing only one-half a grain of cocaine, a safe quantity for an adult. Ether or chloroform can be substituted quickly when surgical procedure on the gastroenteron is indicated.

There is no always or no never in medicine. This is well exemplified in the early diagnosis of this disease. The surgeon has a right to believe that many of these cases can be diagnosed earlier than he usually sees them. But he must also remember that a few cannot. And the internist likewise must be respectful of his full duty to these patients, and not fail to gain or lose sight of the valuable moment in which substantial help might have been offered.

Diagnosis of Atypical Forms of Cancer.—The atypical forms of cancer may be said to be those which manifest themselves in early or very late life, those which run a very rapid course, and those which give a subacute history over a more prolonged duration of time than is generally seen in cancer.

As to age, it has already been mentioned that cancer may occur in early age. Mathieu[6] collected 32 cases occurring in young persons. Because of the greater prevalence of sarcoma in early years these patients are liable to be mistaken as suffering from that disease, particularly because, in the young, cancer cachexia may be absent or occur only very late. Cancer in the very old is a still rarer affection, and one even less liable to be diagnosed than those in early life. They are usually of the infiltrating type, diffusing themselves in all directions and tissues so that at autopsy it is quite difficult to tell whether the growth was originally gastric or not. These growths are often quite calcareous.

Cancer again may present itself in a markedly malignant form, carrying a case to a fatal termination in from one to four months. These cases are very rare, and present the picture of an acute illness of a mysterious nature. Even should a tumor become palpable, it is

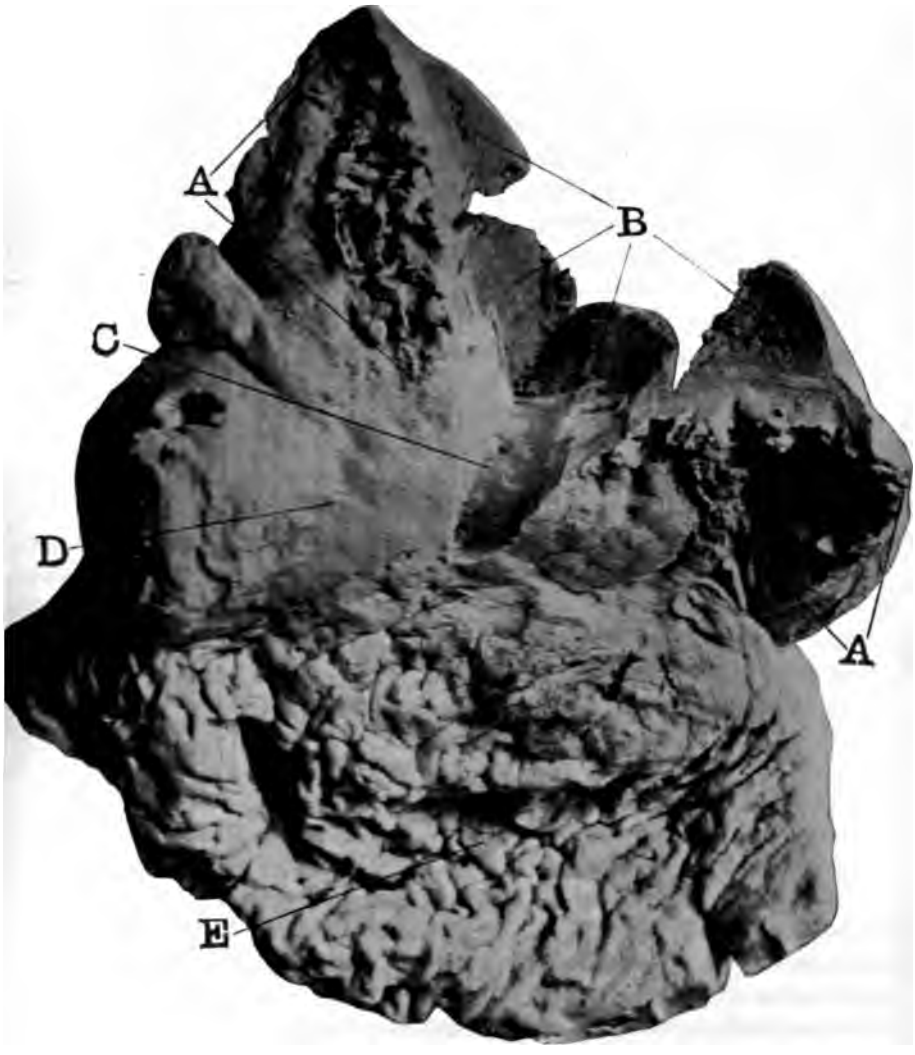
impossible to differentiate these cases from those of a rapid form of sarcoma.

The cancers which give a latent history are usually the forms of encapsulated growths, or a very low form of malignancy of the scirrhous type. They are not so uncommon as was formerly supposed. These types are always suggestive of the long presence of a profusely organized chronic ulcer, which, in the course of time, undergoes malignant degeneration. They are the types of cancer which under higher feedings are liable to show a length of progress in a favorable way, and because of this may be very confusing. One of my patients of this kind gained under a frequent milk and egg feeding 35 pounds in four months, only in the end of an acute course to lose it before death.

ULCUS CARCINOMATOSUM.

Atypical cell proliferation may take place upon the basis of a benign ulcer causing the development of cancer. As far as we can judge clinically and at autopsy, the development of most of the cases of ordinary gastric cancer occurs as a primary affection. According to Boas,[7] the development of malignant degeneration on an ulcer is a not very frequent occurrence. On the other hand, Mayo, Rodman, Mumford and Stone, and others, claim this to be commonly the fact. To this latter view I stringently adhere, and wish to add that any continuous ulcer (chronic), an unhealed ulcer of the acute type, and protruding cicatrix (particularly one of some width) persisting through middle life, may, at any time, become cancerous. I am not of the belief, entertained by some surgeons, that 90 per cent. of all carcinomata have their starting point in ulcer. It occurs to me, based upon the history of the cases which I have observed, that many more than 10 per cent. develop in cases who have never had any dyspeptic symptoms, or who have had pathological states other than ulcer as forerunners. Among these I would mention long-standing states of hypersecretion, continued irritability of the gastric mucosa from whatever cause, and states of chronic gastritis that have been long abused. Of course, one can never be sure in these cancer cases that an ulcer does not or may not have existed. We have only the clinical aspect of ulcer to guide us, and this, as is well known in many ulcer cases, is far from suggestive. Autopsy findings in persons who have died of other than gastric affections have often caused the surprise of the presence of an unknown ulcer healed in the stomach with almost the same degree of regularity as fibrous and calcareous masses in the lungs from a similarly unknown tuberculosis. With these facts in mind, the point between von Mikulicz's statement that 7 per cent. of

PLATE XLV.



Ulcus carcinomatosum. *A, A* denote the edges of the chronic ulcer. *B,* The carcinoma mass beyond it. *C,* Deep cut through the specimen showing a marked formation of connective tissue between the ulcer and the carcinoma proper. The smooth appearance of the mucosa at *D* is due to the thickened connective tissue. *E* shows the mucosa of a chronic gastritis. Entire organ moderately enlarged.

cancers follow old ulcer, and W. J. Mayo's that "a very large proportion of the cases which we have had gave an early history of ulcer of the stomach," the matter is plainly in favor of the latter author being nearer to the fact, particularly as cancer is found most frequently in the ulcer-bearing area. In favor again of carcinoma being a primary affection are the statistics of Robson and Moynihan that, in the posterior surface, ulcers were found in 25 per cent. of instances, while in cancer they were present in but 4 per cent. of the cases. Fütterer has pointed out that ulcers which become carcinomatous begin in localized areas, usually in those which are subjected to the greatest mechanical irritations.

The "fishhook" appearance of carcinomatous ulcer (Hemmeter and Ames[8]), in my experience, has not been so common as that of a cup-shaped depression in the mucosa more or less filled in with a shaggy formation of connective tissue, and in which the carcinomatous infiltration is uniformly general. Abundant connective-tissue growth causing a thickened mass is often observed, so that in viewing the cancer from the mucosa side no typical cancer formation is noted, while in the depths and from the peritoneal side the picture is quite perfect. A rather soft form of ulcer may be seen which looks innocent enough to the naked eye, but which when viewed through the microscope displays carcinoma cells about its edges.

The diagnosis is made from a history of the presence of chronic ulcer and the progressive cachexia and tumor in a stomach which persists in its secretion of hydrochloric acid. Moderately delayed exit and increased fermentation of foods are usually present and gas results from test-meals may be positive. Hematemesis or melena would aid to the diagnosis. The bleeding, however, may be intermittent and profuse enough to suggest a simple ulcer. Sometimes, although hydrochloric acid be present, lactic acid in increased amounts will be found in the stomach. This is due to motor insufficiency, the mechanical obstruction of the mass at the pylorus, or contraction of an overlying old ulcer scar. When a definite tumor is absent the diagnosis may be difficult, although its continuous middle ground in symptoms between acute ulcer and cancer is strongly suspicious. A number of cases cannot be diagnosed as other than chronic ulcer or hypertrophic stenosis, but as surgical therapy is indicated in both of these affections, and often is of great value in ulcus carcinomatosum, resort to this before definite symptoms have appeared is advisable in both the diagnostic and proper treatment way.

TREATMENT OF CANCER.

Surgical.—Most cases of stomach cancer terminate fatally in about one year. In its early stages, before there has been much involvement of tissue, it is distinctly a surgical affection, fairly possible of a cure. When the tumor is definitely palpable from without, and the symptoms moderately advanced, the value of surgery becomes much in doubt, and when the classical subjective and objective picture of malignant disease is established, the only possibility of surgery is in the relief of symptoms by establishing better drainage of the stomach or the removal of the major part of the malignant growth, or both, and these are but rarely possible in any safe way. It may be said as a practical fact—found in the great majority of instances—that when a carcinomatous tumor of the stomach is plainly palpable through the abdominal walls, or when, whether this is evident or not, the chemicobacteriodynamic syndrome of the stomach is characteristic of advanced disease, operation should not be advised. This is so because, when these abdomens are opened, more actual involvement of tissue is present than was supposed (making its removal an almost fatal matter); the presence of before unrecognizable metastasis in tissues impossible or fatal of removal; the very weakened condition of the patient for operation; and the poor results in the way of union of tissues that have been primarily or secondarily affected by the disease.

By the modern awakening of interest in gastro-intestinal subjects, and in the earlier recognition and better selection of cases for surgery, and the improvements in the way of surgical technique in abdominal work, much better results than formerly are being brought about. A further continuance and advance in these will no doubt bring down the rate of mortality in resections to a much lower level as time runs on. In fact to-day some men and also institutions where close attention is given to these cases, and all gastro-intestinal conditions are studied more closely from an internist's standpoint before surgical operations are performed, are showing results which are altogether most gratifying. Patients must be made to understand that operation for cancer is a primary rather than an ultimate matter. When in a case in which the possibilities of surgery offer hope—either in the way of diagnosis or removal—the matter should be put squarely and frankly to the patient, and the responsibility of delay put upon him.

The operations of the radical kind are the pylorectomies, partial and complete gastrectomies and excision of the tumor. These, with the anastomosis operations, are described in Chapter XVI.

PLATE XLVI.

Photomicrograph of an ulcus carcinomatosum in the lesser curvature of the ach. *A*, Detritus covering the floor of the ulcer. *B*, *B*, Fibrous tissue which taken the place of the gastric tubules, the latter entirely destroyed. *C*, *C*, *C*, cened submucosa composed of connective tissue with carcinoma cells grouped and there. *D*, Muscularis mucosa. *E*, Artery. *F*, Vein. *G*, Muscular layer. Connective tissue, much thickened. *I*, *I*, *I*, Large carcinoma nodule. *J*, *J*, ule around same. *K*, Peritoneum. Stained with Van Gieson (Hanson). ½ diameters.

A matter of practical interest to the internist is the effect on the stomach of pylorectomy or partial gastrectomy. It has been proven that the removal of the pylorus improves the motor activity of the stomach and favors the emptying of the organ. The secretory activity is not altered in the majority of the cases, and in some the secretion of hydrochloric acid is benefited. With better drainage, of course, stagnation ceases to be so much of a feature, and the lactic acid and bacterial content falls.

Of the palliative operations are included gastrostomy and esophagogastrostomy (for stenotic and malignant affections of the cardia and esophagus), and the various forms of gastro-enterostomies, which are all drainage operations permitting of more direct exit of chyme into the intestines. As a class, these are operations of value. The first (gastrostomy) permits of direct feeding into the stomach in those who cannot deliver food into the stomach by way of the esophagus in the natural way by establishing a patent canal, and the second, the conversion of the stomach into a canal so that foods can be digested in the intestine. All are measures of much value in the prolongation of life, and often in the relief of the symptoms.

In all cases in which the diagnosis of late carcinoma has been made there are two matters always to be kept in mind. First, it may not be cancer, but the growth be due to internal syphilis—thus the specific treatment should be tried for a while; and, second, even when unmistakable and inoperable cancer is noted at operation, a portion of the growth should be secured and examined to note if the neoplasm is epithelial or endothelial in nature—cases of the latter may often be cured or markedly improved by the assiduous employment of the X-rays.

Medical Treatment.—The medical care of these cases evolves itself into the following parts: Measures to better the state of gastric secretion and motility; measures to better the local symptoms and general state of body; anodyne measures to relieve pain and distress.

In considering the above in general manner it must be said that much can be done in the way of relief to help these unfortunate cases. Two measures, particularly, stand out from the rest as of the most value, namely, regular lavage of the stomach, and the use of morphine. Added to these are a suitable diet, and the use of medicinal agents to control the symptoms.

Whenever stagnation of foods exists, where the hydrochloric acid is absent or very low and organic acids are present, for profound anorexia even when nausea and vomiting are a feature, regular lavage mornings and possibly also evenings is a means of much benefit almost to the end of the case. In addition to its being the best thera-

peutic measure for the anorexia, eructations, and collective vomiting, it acts in a surgical sense in clearing out the fetid contents by removing the products of fermentation and putrefaction. Together with the toxic products from the cancer itself that collect in the stomach, it removes decomposing foods, the products of which have a damaging effect upon the stomach in the local way, thereby causing the intensifying of the subjective symptoms. Lavage also lessens the degree of the bad effects of these combined toxins on the general body (anemia, cachexia, etc.).

The cleansing of the stomach is best done by the Leube-Rosenthal method of lavage, but may be successfully performed with the single tube and funnel apparatus. The lavaging should be continued until the water returns clear, whereupon the stomach may be considered clean. While the method itself with simple saline or borate solution is the best tonic for these cases that can be employed, the following may advantageously be made use of when stagnation and fermentation are pronounced: Resorcin, 10 to 30 : 1000; salicylic acid, 3 : 1000; thymol, 5 : 1000, and hydrochloric acid, 5 : 1000. A good plan is to employ the simple solution for cleaning the stomach, and then finishing the lavage with one of the disinfecting solutions, of which the hydrochloric acid is of the best service in the majority of cases. Occasionally in late cases lavage is too severe a procedure and is liable to bring on a collapse. In these instances rectal feeding may be resorted to for a while to do away with the collection and decomposition of foods in the stomach. But it must be said that rectal feedings here are virtually never productive of any benefit, and may do actual harm.

In the use of opium (morphine, codeine) it may be said that there should be no objection when the diagnosis is sure and the pain and general distress severe enough to warrant it. Cancer is a fatal disease of short duration, and it makes no difference whether the habit be contracted or not. In fact it is a Godsend to many late cases should this be so, for then, all symptoms together and the running course of general distress are much relieved. It should never be employed by mouth, because the dose is only minutely absorbed from these stomachs and vomiting may be increased. The hypodermic method, or, less favorably, the rectal administration, is to be preferred. For the pain cocaine hydrochloride may be employed, either in the form of solution run down through the tube after the lavage, or by mixture. In stagnant stomachs the single installation of a 0.03 to 0.06 gramme (½ to 1 grain) dose mornings often acts as an efficient local anodyne and sedative. I have observed that its action is much prolonged beyond what one would expect from cocaine (this is prob-

ably due to the solution remaining in the stomach for a long time). A recipe of value for continued use is the following:—

℞ Cocainæ hydrochloridi ..... 0.7 gr. xj
Tincturæ valerianæ..... 60.0 ℥ij
Aquæ chloroformi..... ..... ad 120.0 ℥iv

M. Sig.: Take one teaspoonful in water every four hours through a tube.

Codeine and belladonna by mouth may relieve the pain and distress in the way of controlling local secretion in the stomach, a matter in stenosis with dilatation that is always a prominent feature. External applications of heat or cold have a moderate effect not much to be depended upon.

For a favorable general effect upon a cancerous stomach condurango was at one time lauded as a specific. Extensive use has blasted its employment until to-day it is looked upon with derision. It is, however, the best stomachic tonic we have in these cases, and if an appetite can be aroused or digestion improved at all it answers best of any medication. A formula of service is:—

℞ Fluidextracti condurango..... 90.0 ℥iij
Tincturæ nucis vomicæ..... 15.0 ʒiv
Acidi hydrochlorici dil. ..... 20.0 ʒv
Elixir gentianæ .....ad 180.0 ℥vj

M. Sig.: Take two teaspoonfuls in wineglass of water, after meals, through a tube.

When the anemia is pronounced, the hematinic tonics are of value. Among these I would suggest the preparations of the National Formulary: Elixir gentianæ et tinctura ferri chloridi and liquor ferri peptonati cum mangano. To these strychnia sulphate may be added. For the vomiting of reflex or general toxic nature, as well as for the sleeplessness, the bromides in full doses are of benefit; these may be used per rectum as well as by mouth. The constipation is best relieved by rectal enemata; and the diarrhea by bismuth salicylate, benzonaphthol, columbo, opium and the time-honored pilulæ plumbi et opii is also of value.

Of first importance in the medical care of these cases is proper dieting. The nature and character of this depends entirely upon the chemico-dynamic state of the stomach. Naturally, one would desire to feed these patients so that their distress would not be intensified and at the same time keep close to their power and capacity of utilizing food. When pyloric stenosis of a marked degree exists, only the fluid form of nutriments should be used. Among these may be mentioned the fermented milks, cream, vegetable purée, soups, eggs (raw or soft-boiled); cocoa butter, the peptone preparations of food, milk powders, tea, coffee, ale, etc. If prostration be present, cognac (diluted) or iced champagne in small doses may be added. When the

s ry irritable only fluid foods should be employed in small .antities and at intervals of one hour.

When pyloric stenosis is not so much of a feature in a case, the feeding should be liberal in selection and generous in amount, employing the food in smaller quantities at a time and in four or less hour intervals. The more food per day the patient can take and assimilate, the better the general state of health, strength and fortitude against distress. These patients should be permitted to partake of whatever foods they may care for; preference, of course, should be governed by their nutritiousness. When hydrochloric acid is entirely absent from the stomach, it is sometimes advisable to control the amount of animal proteins partaken of and meet the shortage with the farinaceous vegetables and fats.

References.

[1] Haeberlin: Deutsch. Archiv f. klin. Med., 1889, Heft 3 und 4.
[2] J. D. Bryant: The New York Medical Journal, May 18, 1895.
[3] Schneyer: Inaugural Dissertation, Berlin, 1888.
[4] Boas: "Diseases of the Stomach," p. 578.
[5] Bassler: "Extracting Test-meals," New York Medical Journal, June, 1908.
[6] M. Mathieu: Gazette des Hôpitaux, 1884, No. 118; monograph, Paris, 1884.
[7] Boas: "Diseases of the Stomach," p. 588.
[8] Hemmeter and Ames: New York Medical Record, September 11, 1897.

CHAPTER XXII.

Organic Diseases of the Stomach.

(*Continued.*)

GASTRIC SARCOMATA.

ETIOLOGY.

A SARCOMA is a connective-tissue growth whose cell elements, either because of their number or size, predominate over the intercellular substance. In this way they differ pathologically from carcinoma, which originates in the epithelia, although in the soft forms of cancer the distinction is not marked.

Being a less common form of malignant growth than cancer, sarcoma has not excited the same interest in the pathology of the stomach that cancer has. There is no doubt, however, that future years and more general use of the microscope will show sarcoma of the stomach to be more frequent than it was formerly thought to be. My reason for this is that in the past too much dependence has been placed upon the gross appearance of growths, which is extremely unreliable in differentiating between ordinary carcinoma and some varieties of sarcoma and endothelioma. Sir C. Perry and Dr. L. Shaw, out of 50 cases of primary malignant disease of the stomach, found that the growth was sarcomatous in 4 (8 per cent.).

Unlike carcinoma, sarcoma is most often a disease of young adults or even of the child, although certain forms of sarcoma seem to be most common in the old. We know no more about its origin than carcinoma, excepting that cases have been met with in which local trauma has definitely occurred. Notable among such is a case reported by Brooks,[1] in which a diffuse sarcomatous deposit occurred in the scar of an old stomach wound which was inflicted by a gunshot injury received over thirty years before and part of the course of which was noted in the superior surface of the left lobe of the liver corresponding to the wound of entrance and the location of the sarcomatous deposit (autopsy). Sex does not show any particular difference as to the frequency of its occurrence. A parasitic origin has not been demonstrated. Cohnheim's theory pertaining to the origin of cancer seems to have a greater significance in sarcoma for the reason that the latter growths are so closely related to undeveloped connective tissue that sarcomatous tissue may be compared to embryonal tissue.

PATHOLOGY.

Sarcomata are connective-tissue tumors developing either in parent connective tissue or in deposits of connective tissue such as are found in the benign growths. The transformation of the connective tissue into tumor takes place through growth and multiplication of the existing cells, the proliferation of cells occurring by mitosis, which, in rapid growths, are the more abundant.

The sarcomata of the stomach may develop primarily or secondarily. The primary forms are seen as circumscribed, nodular tumors usually located at the greater curvature. This so-called medullary variety is very soft and cellular, poor in intercellular substance, is more common in the liver and intestines than the stomach and in the stomach usually presents a hemorrhagic surface and on section a marrow-like white or grayish-white surface. The harder forms are more dense and white on cut surface, poor in cells and rich in fibrous intercellular substance, and pass by insensible gradations into fibromata (fibrosarcoma). They arise either in the muscular or submucous layer, while the glandularis above remains intact or may ulcerate for the same reasons as in cancer, *i.e.*, usually from necrosis brought on by strangulation of the circulation. The forms that have been noted by Salaman are the lymphosarcoma, round-celled sarcoma, polypoid fibro- and myxo-sarcomas of the stomach, and sarcoma of the peritoneal glands directly invading the stomach; to these, to cover the varieties of growths as they are histologically seen, may be added myosarcoma, spindle-celled sarcoma and angiosarcoma. A histological classification of these tumors is notoriously very difficult. In all forms, retrograde changes (fatty and mucous degeneration, caseation, necrosis, gangrene, liquefaction and ulceration) are common.

At autopsy in these cases the stomach displays many varieties of malignant formation. The growth may be flat and diffuse, showing thickening of the walls without definitely circumscribed tumor formation, and the stomach as a whole may be small and, except for the ulcerated areas, its mucosa free and anemic (myo-, myxo- and angiosarcoma). On the other hand, the stomach may be of enormous size with large rounded swellings plainly showing on both the glandularis and peritoneal surfaces of the organ. In large growths the glands lying around the celiac axis are usually involved and may be continuous with the walls of the stomach so as to make a thickened united mass. The inner surface of the stomach may be coated with a ragged, greenish layer of slough and slime, and under the microscope a patch of mucous membrane which presents no visible abnormalities may show a

PLATE XLVII.

Primary myosarcoma in the greater curvature of the stomach. The tumor grew inward into the cavity of the organ but still caused a bulging of the peritoneum, evidencing its presence before the stomach was entered. The thick dark line in the upper part of growth and the small cavity to the left of it represent where pieces had been taken out for microscopic examination. The entire organ itself was not much enlarged and the walls not much thickened. The glandulature showed marked cellular change (degeneration).

marked round-celled infiltration. In such large-sized primary growths the inner coat is usually very atrophic and necrotic, which, according to Salaman,[2] is not due to any growths in it, but is part of the gangrenous gastritis seen everywhere. The pancreas may be adherent, and multiple raised ulcers may be seen in the intestine. Other cases are noted in which the transition from sarcomatous formation to the glandular layer is sharp and the parenchymatous cells of the latter, even the central, are normal. In the Kundrat type of lymphosarcoma enlarged glands are commonly met with everywhere, even extending to the kidneys and the ovaries. The polypoid fibro- and myo-sarcoma and round-celled sarcoma are more often free from extensive abdominal involvement with perhaps no enlarged glands. The intestine may be adherent in places, small miliary deposits in the peritoneum (which resemble those of miliary tuberculosis) may be observed, the spleen may be enlarged, and chronic nephritis is common.

In multiple sarcomata or extensive metastases from sarcoma primarily situated elsewhere than in the abdominal cavity, the general organs and the peritoneum may display numerous metastatic growths with more or less of them discretely scattered throughout the walls of the stomach.

SYMPTOMS AND DIAGNOSIS.

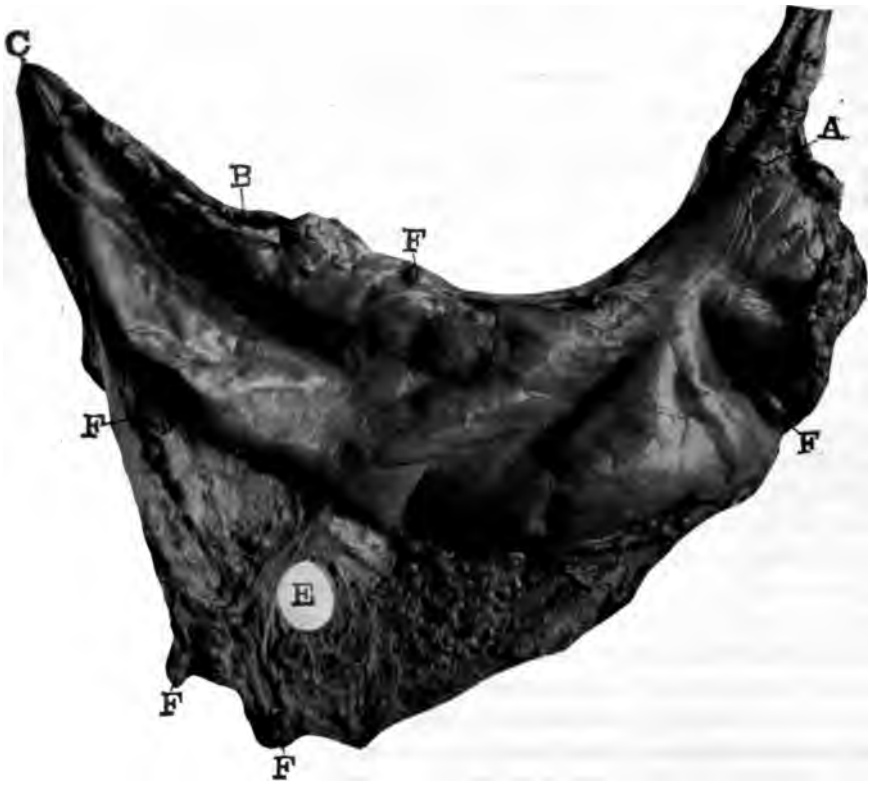
In cases of secondary involvement of the abdominal organs where evident extensive metastases from a parent growth exist, the diagnosis can only be made by assumption, for, as a rule, no special abdominal symptoms are present. In the primary forms, much of the detail of symptomatology that is found under cancer also answers for sarcoma. In a close perusal of the clinical history of 29 cases that have been reported it is plain that vomiting of blood is a much more constant feature in cases of sarcoma than in carcinoma, and in character this appears to be earlier and larger in extent than cancer and more like that due to acute ulcer.

The subjective symptoms resemble those of cancer, but the cases generally run a more rapid course from the beginning of symptoms to fatality, which is all the way from two weeks to six months. The more chronic and fibrous forms, however, simulate cancer in this way. There is usually a history of a certain amount of prior digestive disturbance rather suddenly developing into vomiting, hematemesis, severe anorexia, weakness and emaciation. Pains in the epigastrium are usually present, and these are liable to be more constant as in ulcer and not so nocturnal as in cancer. In a case under my observation aversion to meat was at no time present.

As to the objective symptoms, there are two matters that are liable to be particularly misleading in diagnosis, and these are, that, because of the localized formation of the primary growth and the fact that the general glandularis usually is not involved, the secretion of HCl and the enzymes is liable to persist to the end (as in ulcus carcinomatosum), and obstruction at the pylorus (as in cancer) is not likely to be present. In lymphosarcoma there may be marked dilation of the stomach without pyloric obstruction, in which, from the poor and failing general condition of the patient and the hematemesis, the differential diagnosis between it and primary atony, latent or chronic ulcer and cancer would have to be considered. Naturally, a dilated stomach which empties itself of food over night argues against secondary atony, and bleeding which does not improve under the ulcer treatment must be considered as due to malignant disease or, better yet, a case for exploratory incision. The Boas-Oppler bacilli are not common but have been reported in a few instances; they are much more regularly found in cancer. Blood in the test-meals is rather constant, and, as was mentioned above, is liable to be larger in amounts than in the early stages of carcinoma. If gastric analyses are not being made the examination of the feces for blood is of course most important and essential. Lactic acid may or may not be present, depending upon whether pyloric obstruction or thickening of the stomach wall interfering with proper motility exists. According to Fenwick, the sulphocyanide of potassium in the saliva gradually disappears about one month before death. The gastric contents should be searched for tumor particles, and in a suspected case a fragment from the tumor may be dislodged by lavaging the organ with the inflow delivered under considerable pressure. Persistent albuminuria is often observed in sarcoma, but is exceptional in cancer.

The patients usually display more or less emaciation with marked anemia and, late in the case, cachexia. Purpuric spots or blotches may be observed. On physical examination a tumor may or may not be palpable; this depends upon the formation and size of the growth, which, in one of Salaman's cases, weighed 14 pounds. When emaciation is marked enough so that palpation of the abdomen is an easy matter, a firm, globular mass in the epigastrium at about the midline may be recognized. Generally this is tender to pressure and accompanied by rigidity of the recti in that region. Inflation of the stomach and auscultatory percussion may show the tumor to be attached to the stomach. An early rise in temperature, 40° C. (104° F.), of a continuous character, with a pulse of 110 and respirations in the twenties, may exist; even late in cancer the rise in temperature is not so high

PLATE XLVIII.



Exterior of a stomach from a case of multiple sarcoma. Sarcoma metastases were also found in the heart, pericardium, lungs, liver, spleen, mesentery, pancreas, uterus, etc. Three small growths were found in the glandularis. *A*, Pylorus, duodenum above it. *B*, Cardia. *C*, Fundus. *E*, Greater omentum. *F, F, F, F, F*, Small sarcomata, found also in other places on the specimen.

or constant. The soft forms of sarcoma are more rapid toward fatality than the medullary carcinomas, the average clinical course being about six months. With the mixed varieties of sarcomata the fatal result may be delayed as long as three years; as compared to the common hard form of cancer about double the length of time may be considered closer to the average.

TREATMENT.

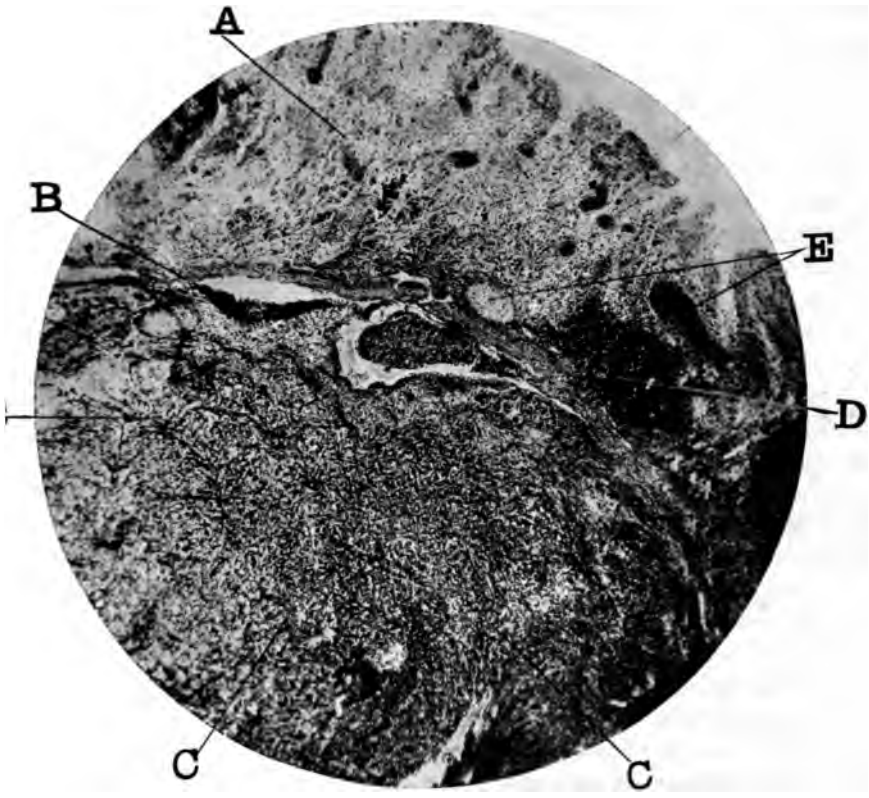
Surgical.—In every case in which the diagnosis of malignant disease of the stomach is suggested, surgery should be the first thought as the proper therapeutic course to advise. In sarcoma of the stomach, as in cancer, the desirability of this depends upon the general condition of the patient and the local findings on examination (for the reason that operations of extirpation are always serious matters and should not be instituted in late cases). Cases have been reported in which the results from operation have been good, but for the reason that metastases and recurrence in sarcoma are so common one should not be too exultant or definite in the prognostic way. At operation the tumor may be recognized as a purplish, nodular mass, hemispherical in shape, and situated at the lesser curvature. In such an instance a V-shaped resection from the anterior wall and a partial resection of the lesser curvature would be required. Obviously, the excised portion should include a free margin of normal appearing glandularis around the growth, because usually on the peritoneal surface the edge of the tumor passes by undistinguishable gradations into the mucosa and it would be important to include the surrounding cell infiltration. In what appears to be a successful case, the post-operative prophylaxis against recurrence is most important, and these comprise particularly the use of Coley's mixed toxins and the therapeutic employment of the X-rays.

Medical.—As a prophylactic against recurrence and the treatment for inoperable cases there are two measures that have excited broad interest, namely Coley's mixed toxins and the X-rays. Remembering that a small proportion of carcinoma cases are really instances of sarcomata, these may also be tried in all of the inoperable cases of malignant disease. My deductions, however, with both of them are that they answer to a far greater proportion of successes in the less deeply seated carcinomas (X-rays) and in sarcomas of the long bones (Coley's mixed toxins).

Based upon the clinical fact that a considerable proportion of cases of inoperable cancer of all varieties and especially sarcoma have been known to disappear under attacks of accidental erysipelas and the

patients have remained well thereafter, Coley[3] has suggested the use of the mixed toxins of erysipelas and bacillus prodigiosus in inoperable sarcoma. Other than from the successful treatment of 51 cases of inoperable sarcoma by Coley, in the great majority of which a careful microscopical examination had been made and were adjudged inoperable by leading surgeons, Tracy and Beebe have shown that large multiple sarcomas in dogs rapidly disappeared under local or systemic injections with the mixed toxins. Coley believes that the following are the indications for the use of the mixed toxins: (1) in all cases of inoperable sarcoma, excepting the melanotic, which are probably of epithelial origin; (2) in cases of sarcoma originating in the long bones, in which operation means the sacrifice of a limb; (3) immediately after operation (within a week or two) in all primary inoperable cases as a prophylactic against recurrence; (4) in addition to the foregoing, after primary operations for carcinoma as a prophylactic against recurrence. The use of the toxins as a prophylactic after operation he believes offers by far the most important field of all, the proportion of recurrences in his own experience thus far being less than 25 per cent., whereas in cases in which the toxins were not used after operation the proportion of recurrences had been fully 75 per cent. As regards the dangers from the use of the toxins, he states that personally he has found their administration practically free from danger. However, he has learned of several fatal cases in the hands of other men, which, taken together, shows that there are certain risks connected with the treatment. He believes that, if the precautions he had always made it a point to emphasize were observed, these risks would be reduced to a minimum. Most of the fatal cases that occurred were due to neglect of those precautions. For use after operation small-sized doses are advised, only sufficient to bring the temperature up to 99° or 100° F. (37.2° or 37.8° C.) three times a week, and continued for five or six weeks. According to Coley, in treating inoperable cases it is well to begin the systemic injections in every case with a very small dose, not over ¼ minim, diluted with a little boiled water to insure accuracy of dosage. In a short time the quantity should be increased to ½ to ¾ of a minim at a dose and kept up until the desired reaction is obtained, which corresponds to a reaction of 39° to 40.6° C. (102° to 105° F.). The frequency of the injections depends upon the strength of the patient, some being able to bear daily injections, while in others it may be unwise to push the treatment beyond three or four injections a week. In successful cases the effect is usually promptly noticeable; the tumor becomes smaller in size, much more movable and very much less vascular—these changes may appear within two or three days.

PLATE XLIX.



Photomicrograph of one of the small sarcoma metastases from Plate XLVIII, which was projecting into the cavity of the stomach (endothelioma). *A*, Gastric mucosa densely infiltrated with sarcoma cells. *B*, Connective tissue between same and the sarcoma mass. *C*, *C*, *C*. Bulky deposit of small and large sarcoma cells. *D*. Lymph nodule. *E*. Veins filled with blood-cells. Stained with Van Gieson (Hansen). × 54 diameters.

If improvement does occur, the treatment should be kept up, either until the tumor has entirely disappeared or until it has become evident that the injections have lost their inhibitory influence. If precautions are observed the injections can be kept up in moderate doses for long periods without harm to the patient. If no improvement has occurred at the end of three or four weeks of daily injections the treatment is not likely to be successful.

It has been proven that sarcomas yield better to the X-rays than carcinoma. Numerous cases of sarcoma of the long bones are on record in which the Roentgen rays have caused a liquefaction of the tumor with recovery or assisted to these ends by surgery at the end of a course of rayings. Pfahler[4] in an article on this subject drew attention to the desirability of raying as a post-operative measure following malignant disease and stated that it seemed we might hope for 50 per cent. of recoveries in sarcoma. In the series he reported 65 per cent. had recovered. In cancer of an advanced type good results are occasionally met with, but generally one can hope only for palliation or prolongation of life. The foregoing pertains particularly to cancer of the internal organs, and not to the superficial structures of the body.

Other than the above, the symptomatic treatment of sarcoma of the stomach is identical with that of cancer, and will be found described in detail in connection with Chapter XXI.

References.

[1] Harlow Brooks: Medical News, May 14, 1898.
[2] Salaman: Trans. of the Path. Soc. of London, 1904, vol. lv.
[3] Coley: Annals of Surgery, September, 1891.
[4] Pfahler: American Journal of the Medical Sciences, April, 1909.

CHAPTER XXIII.

Organic Diseases of the Stomach.

(*Continued.*)

BENIGN TUMORS OF THE STOMACH.

GENERAL CONSIDERATION.

THE stomach may be the seat of several kinds of tumors of the benign type. Taken collectively, however, these are very rare, the great majority of the palpable growths being carcinomatous in nature. Among the forms of benign growths that have been found may be mentioned adenoma and papilloma, myoma and fibromyoma, lipoma, myxoma, lymphadenoma, polypi and retention cysts, to which may be added gastroliths and foreign bodies, and the thickenings of the pylorus (hypertrophic stenosis).

PATHOLOGY.

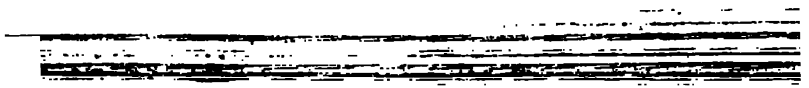
Adenomata and Papillomata.—As a rule, the first of these are found as small, white, translucent, irregular growths composed of tubular structures, and the papillomata as wart-like or pedunculated growths of a firmer consistence. Adenomata may also occur in the intestines and may be found with a pronounced glandular structure, in which instance they closely simulate malignant formation and thus have been termed malignant adenomata or adenocarcinomata.

Myomata and Fibromyomata.—The myomata develop in the muscular layer and extend into the cavity of the organ. They are often numerous and of small size, forming slight elevations of the mucous membrane, but may be single and of considerable size and perhaps pedunculated. Unless of some size they are very liable to be overlooked at autopsy. The fibromyomata are found somewhat larger than the myomata and may reach in size up to a pigeon's egg. Like the myomata, they consist of unstriped muscular tissue with the addition of fibrous tissue. As a rule, the mucous membrane is intact and normal over these growths.

Lipomata.—Small-sized lipomata are occasionally seen in the submucous coat. Like the myomata and fibromyomata, they are generally seen small in size, forming projections which are covered with mucous membranes but which thins out as the tumor increases in size. More

PLATE L.

Papilloma near the pylorus. The growth was about the size of a large elongated walnut and was pedunculated. The growth hangs off from the specimen and presents a secondary warty growth near its summit. The structures in the walls of the stomach were not pathological.



rarely the tumor separates the muscular fibers, forming small hernias under the serosa. Orth has observed lipomata growing from the serosa in a pedunculous manner, and a large tumor of this kind may cause digestive disturbance by the dragging of its weight on the stomach.

Myxomata.—These growths consist of fragile connective tissue. They are seen as small, jelly-like deposits containing much mucin and are usually complex in make-up, such as myxolipoma, myxofibroma and myxoadenoma. On cut surface they are pale grayish or reddish white in color, and when microscopically examined generally display a thin capsule which extends by fine stellate prolongations into the growth. The myxomata grow from the connective tissue in the submucous or intermuscular tissue. Their growth is slow and rarely attain considerable size in the stomach, although when mixed with sarcoma cells they may develop very rapidly. In other instances they are pedunculated (mucous polypi), may be as large as a hazelnut, and may be quite numerous in the pyloric region. The formation of these growths has been attributed to a chronic gastritis, the tumor being formed at the expense of the glandularis and submucous coat. The latter form of myxomata is not so rare, Epstein having noted it in 14 out of 600 autopsies. They are generally found in middle life and are twice as frequently observed in men as in women. They are usually covered with a thin layer of mucous membrane.

Lymphadenomata.—Because of their association with sarcoma these growths are clinically the most important of the benign stomach tumors. The benign form (lymphoma) is seen as small nodules scattered over the stomach and usually consist mostly of lymphoid tissue, namely, a delicate reticulum within the meshes of which are numerous lymph corpuscles. The tumors are of a grayish-white color, and soft, yielding a milky-white juice on pressure. Clinically these growths are, for the most part, innocent, and they are often found in the internal organs in Hodgkin's disease, in which disorder they may also be found in the liver, kidneys, spleen, medulla of bones, lungs, etc., as well as in the alimentary canal. The tumors develop in the mucosa and submucosa, project into the lumen of the viscus, and commonly ulcerate, possibly with the development of a fatal hemorrhage (Reimer's observation). The pedunculated growths may develop to considerable size; a number as large as an apple having been reported. The lymphomata occasionally exhibit malignant properties. This is especially the case in those richly cellular, soft, rapidly growing forms that are sometimes met with. Such growths may rapidly infiltrate the surrounding structures, involve the neighboring lymphatic glands, and

more commonly seen in the insane, but may be encounterec instances of vicious habits, such as swallowing of hair or fiber lengths of time, or unusual solid articles, and the very rare insta of collections of vegetable detritus. Such collections, of course, not attached to the stomach but may be present in such quant as almost to fill the cavity of the organ. Of these, the so-called tumors" are the most numerous. The vegetable collections co of starch, vegetable cells, and chlorophyl, but no animal subst The latter collections are usually rounded masses presenting ir midline of the abdomen (pyloric region). A few cases are on r of diverticula of the stomach. These are very rare, and have been diagnosed at operation or noted at autopsy.

Hypertrophy of the Pylorus.—Of these cases there are two cl types, the acquired hypertrophic stenosis of the pylorus accompa a hypertrophic gastritis, and the congenital type; the latter forr be found described in Chapter XXV. Unless the obstruct removed by operation the consequences of hypertrophic stenosi be and generally are as serious as pyloric stenosis due to mal disease. Pathologically, the process is one in which the normal of the gastric walls are replaced by proliferated fibrillar con tissue, the thickening being greatest at the pylorus, although th organ may be smaller from general involvement and contraction pyloric wall may be 2 or 3 centimeters in thickness, the mai being made up by hypertrophy of the muscular structures. T ease occurs mostly in persons between twenty and forty years and in males somewhat more frequently than in females. (

the epigastrium, particularly in thin subjects. In the large pedunculated growths the polypus may act as a ball valve more or less completely occluding the pyloric region. In these instances, the growth may not be felt from without (particularly the mucous ones), may cause a secondary atony of the stomach (dilatation), and the seven-, eight-, nine-hour and morning extraction of mixed meals or those taken the evening before would evidence stagnation. As a rule, the digestive secretion is not disturbed or a high acidity may exist from condensation.

Because of the more relative frequency of ulceration in lymphadenoma as compared to the benign tumors, hematemesis with occult blood in the stools may be observed. Gastric saline instillations may display pus cells and increased bacterial flora—therefore the gas product may be over 2 per cent.

Of the foreign bodies the hair tumors are the most common. In these cases a tumor may be discovered which is soft in texture and can be moved about. Emesis may frequently occur, and from interference with proper gastric digestion excessive eructations are common. A history of chronic digestive disturbance is the rule. These are the cases in which the use of the gastroscope answers to good purpose, both for diagnosis and removal. This instrument may also serve to splendid use for diagnosis and removal of the pedunculated tumors. In a case that was under my observation of a young man who accidentally swallowed a scarf-pin, the X-rays located the pin in the stomach with the pointed end hanging vertically under the tenth rib and removal was easy through a straight-tube gastroscope.

In hypertrophic stenosis the history is that of a chronic gastritis, and a sub-, anachlorhydric or achylic stomach is the rule. A definite, small-sized, hard, globular mass (thickened pylorus) may be palpable in the midline above the umbilicus, or the entire stomach may feel stiffened and unyielding. Fullness, pressure, pain, pyrosis and eructations are generally present, and rather steady vomiting as the case advances. The appetite may not be disturbed. The differential diagnosis between carcinomatous and ulcer stricture of the pylorus would have to be considered, and unless the case is examined exhaustively would be quite difficult. These cases are chronic, and the progress to fatality slow; thus stagnation may not be met with until very late and even then the gastric analysis may not be very conclusive in the way of proving retention.

TREATMENT.

If by the use of the gastroscope the diagnosis of small-sized growths is possible and in those giving no symptoms no special treatment is required. In the larger pedunculated growths and foreign bodies, when these give symptoms and are not situated in the inaccessible pyloric region or lesser curvature, their removal through a gastroscope by one of the excellent special instruments now used for that purpose should be attempted. When removal in this way is not possible and when the growth is in the wall or a hypertrophic stenosis exists, laparotomy is called for. In the pedunculated growths and foreign bodies the stomach cavity should be entered and the growth or bodies removed, and since the danger of recurrence is very small the stomach wound can be closed without further surgery. In growths of the stomach wall more or less removal of stomach tissue is necessary and a gastroenterostomy may be called for when proper stomach drainage cannot be assumed.

In hypertrophic stenosis palliative treatment may answer for a moderate case. In this instance the avoidance of everything that might increase the gastritis should be instituted. Among these is abstinence from alcohol, irritating and hard foods, tobacco, and the use of milk, soft eggs, purées, etc. when HCl secretion exists, and mostly the well-cooked, soft carbohydrates and pancreatin when it does not. Regular stomach lavage with hydrastis or dilute hydrochloric acid answers to good purpose in the routine, particularly when gastric retention is present. In the more severe cases and when the emaciation is progressive and stagnation exists, and the symptoms do not abate under medical treatments, operation should be performed. The form of operation depends altogether upon whether only the pylorus is thickened (pylorectomy and pyloroplasty would then be the ideal forms), or when the entire stomach is involved in the thickening the stomach as an organ of digestion and receptacle for food should be disregarded and a free gastro-enterostomy (in preference to a complete gastrectomy) be performed. When stenosis of a high degree exists the operation should not be postponed a single day. After the stenosis has been relieved, the case requires further dietetic, medical and mechanical treatments according to the consideration of the subject under chronic gastritis.

CHAPTER XXIV.

Infectious Granulomata.

SYPHILIS.

ETIOLOGY.

SYPHILIS is an infectious disease, acquired by contagion or transmitted by inheritance, which runs a chronic course, and the lesion of which is an infectious granuloma. In its late secondary and particularly in its tertiary manifestations no organ of the body is exempt from its ravages, and thus of late much attention is being paid to syphilitic affections of the abdominal viscera as well as to organs situated elsewhere in the body.

Of the numerous causes that have been advanced for this pandemic disease (all of which now can be claimed to have been built up on supposition without scientific confirmation), it remained for Schaudinn working with Hoffmann to establish what now appears to be the true etiology of syphilis. Up to this time, as compiled by Lassar, no fewer than one hundred and twenty-five causes of syphilis had been advanced, and thus it was with becoming modesty that Schaudinn and Hoffmann drew attention to the incidence of the spirochæte pallida, leaving the etiological deductions to others, these two German investigators merely presenting the facts they had obtained. Although the presence of this organism had been noted by Borrel, Gonjou and Bordet before that time, no special significance was attached to them, but within six months after Schaudinn and Hoffmann's paper was read before the Berlin Medical Society (May 17, 1905), the spirochæte pallida was proclaimed as the cause of syphilis by many observers all over the world. The vast amount of work on this subject of the last two years has tended to confirm the fact that the spirochæte pallida is present in luetic lesions and not found elsewhere, and confirmation of the etiological accuracy seems to be clinically proven even if the third and fourth law of Koch still remain unsatisfied. (Osler draws attention to the third law of Koch also not being satisfied with the malarial plasmodium which is now accepted by all as the etiological factor in malaria.)

The spirochæte pallida is a long, delicate, non-refractile, spirally

curved organism, pointed on both ends, with an average length of 4 to 14μ. It is circular on cross-section and the spirillation differs from the more common form of the spirochæte refringens by being more of a corkscrew formation. Both in the stained and fresh specimens, flagellæ have been seen which are somewhat shorter than the entire length of the organism, and these are usually attached one at either end. The organism is motile, the movements being a rotation on its long axis, a whip-like undulation of the whole body without locomotion, and forward and backward movements. Unlike other spirilla, the spirochæte pallida retains its spiral form when at rest; the movements gradually disappear on exposure to the air, but may persist in a normal salt solution for six hours. They are seen as free organisms not connected with tissue cells, but may be noted intimately embracing the red blood-corpuscles. One of the marked features of the organism is its obstinacy to stains, the usual methods of staining being ineffectual to color them at all, or, if so, giving only the very faintest hue and then fading quickly.

It is not within the province of this volume to enter into the technique of staining smears from initial lesions or the tissue from cases of congenital syphilis. Only the subject as it pertains to the internal organs, which are all late manifestations, will be dwelt upon, and because in a severe case the blood examination may offer a valuable clinical examination only the technique of this will be given. For this purpose blood is removed from one of the arm veins (median cephalic, the arm first being constricted by a tightening bandage above to engorge the vessel) by means of a medium-sized (15 cubic centimeter) graduated syringe and a fair-sized aspirating needle. When 1 cubic centimeter of blood has been sucked from the vein, the syringe is removed and 10 cubic centimeters of ⅓ per cent. of acetic acid is drawn up into the barrel. In a few moments after vigorous shaking the admixed contents are removed, thoroughly centrifuged, and thin smears are made from the sediment. Many methods of staining have been advanced, some being too complicated for clinical work. The MacNeal method is quick, simple and satisfactory. By this the specimen is dried in the air and heated on a cover-glass for forty-five seconds in the following solution:—

Methylene-violet (crude)	.25
Methylene-blue (medically pure)	.10
Eosin (yellowish)	.20
Methyl-alcohol (pure)	100.00

It is then dipped in a 1 to 20,000 sodium carbonate solution, swilled it for one or two minutes, washed with water and examined with a

or 1/16 immersion lens. The spirochæte are stained a delicate blue, or much darker if the staining be prolonged. Excellent and quick results are obtained with Goldhorn's polychrome methylene-blue stain, which is prepared as follows: 2 grains of methylene-blue and 4 grains of lithium carbonate are dissolved in 300 cubic centimeters of warm water. The solution is heated in a porcelain dish on a boiling water bath for fifteen minutes, then poured into a glass-stoppered bottle and set aside for several days. Finally it is rendered only slightly alkaline by the addition of 4 to 5 per cent. acetic acid solution (test with litmus paper). The specimens are covered with this dye for three or four seconds, when the excess is drained off. The cover glass or slide is then slowly introduced into clean water with the film side down, the slide is held still in the water for a few seconds, and then shaken in it to wash off the excess of dye. The spirilla appear of a violet color, which may be changed to a bluish black by flooding the preparation for fifteen or twenty seconds with Gram's iodine solution, washing and drying as usual (Simon).

PATHOLOGY AND FREQUENCY.

Late syphilitic disease may manifest itself in the alimentary canal, salivary glands and pancreas, in the spleen and liver. An acute parotitis may occur in the secondary stage, and instances of gummata of the salivary glands have been reported. The sublingual gland is more commonly affected than the parotid and usually only as a late lesion. In these instances the secretory function of the glands is not perceptibly interfered with. The pancreas is rarely attacked, the lesion seen being gummatous in character. Syphilis of the esophagus is described in connection with Chapter XVII.

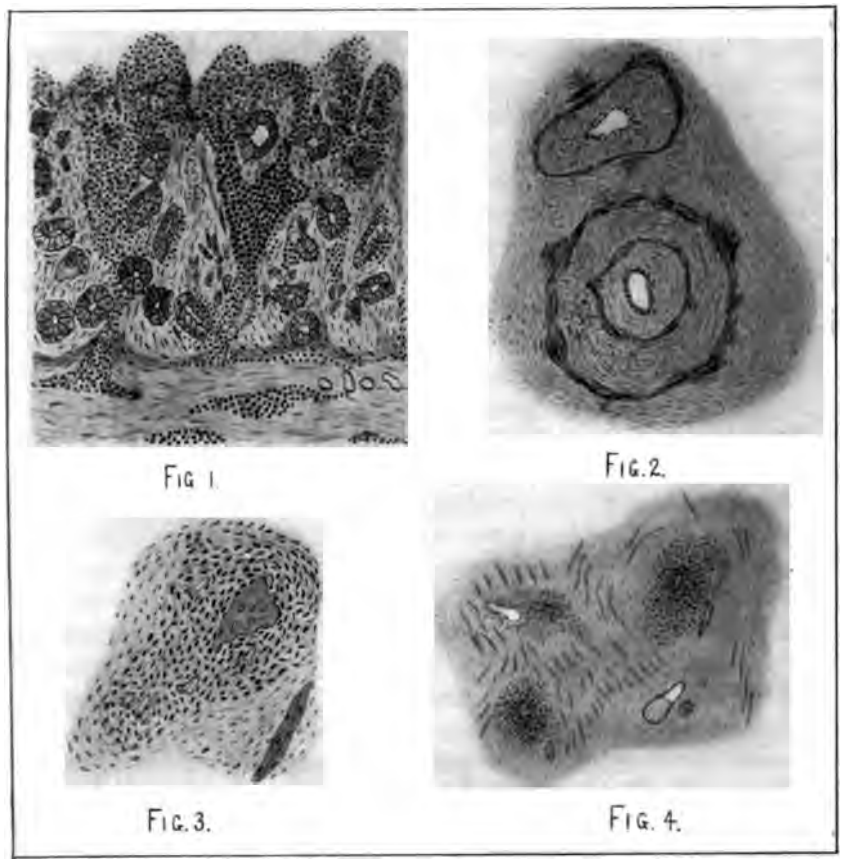
The stomach can be the seat of extensive syphilitic disease, but a great difference of opinion exists as to the frequency with which it is met with in syphilitic individuals. As judged from postmortems on syphilitic patients it would seem to be a very rare affection, although of late years the frequency of authentic cases is constantly on the increase. Chiari[1] in 243 postmortems on syphilitic patients found definite stomach lesions in only 2, and up to the time of this writing not more than twenty trustworthy cases of the acquired and congenital forms have been reported in the literature. On the other hand are men who assume the presence of a syphilitic gastritis in every disturbance of digestion developing in a syphilitic patient. Judging from therapeutic results in clinical experience, both of the above views are extreme. It must be recalled that syphilis of the acquired form is a common disease and many are the individuals that are met with

who in their early lives have had primary and secondary lesions. Added to these are, numerically speaking, the great uncertainty of the inherited form which was not intense enough in degree to cause the deprivation of life in the infant days, or perhaps those who have never presented any clinical symptoms to make diagnosis possible or even suspicious. Masked and latent types of varying degrees of syphilis affecting the internal organs exist in both the acquired and inherited forms, and cases in which the late lesions are more often infiltrative and interstitial rather than gummatous are much more common than the autopsy statistics show, but, of course, they are not so numerous as to warrant viewing every disorder of the internal organs as syphilitic in nature just because no other etiology for some particular disease had been advanced or just because the history of early acquired disease had been obtained. The writer believes, in so far as lesions in the digestive canal are concerned (and possibly also with all other structures of the body), that a conclusive Wassermann test and a favorable result from specific therapy are necessary for diagnosis in the cases of internal organ involvement, and because these have served him well in many more than three-quarters of 1 per cent. of all gastro-intestinal disorders, that syphilitic affections are more common than the autopsies alone would prove, but not so numerous as some have assumed, and that many cases of low degrees of syphilis compatible with life exist which are liable to correct themselves even without resort to specific therapy. In some of the far eastern countries in which the severe oriental type of the disease is common, specific treatment is not used (or at least not so generally as in the more scientific medical centers), and in these countries, while the rate of mortality of syphilis is highest, still, the very largest proportion of the cases apparently recover, the milder cases ofttimes apparently as successfully as with those handled along lines of specific treatment.

In the stomach the disease manifests itself in three types of lesions, namely, a diffuse syphilitic gastritis, syphilitic ulcer, and gumma. To these may be added the sequelæ of perigastric adhesions or pyloric thickenings causing stenosis. The three lesions will be described singly, but it must be remembered that combinations of the three types are commonly met with.

Diffuse syphilitic gastritis is essentially chronic, may be a primary condition, but is commonly an accompaniment of syphilitic disease of other abdominal organs, or an accompaniment of countless gummata in the mucosa and submucosa. With the stomach involvement, syphilitic lesions usually exist in the liver, spleen and pancreas, and

PLATE LI.



Syphilis of the Stomach.

Fig. 1.—Showing the loss of epithelium, duct and gland cells, and extensive round cell infiltration in the inter- and sub-glandulature regions.

Fig. 2.—An artery and vein showing subendothelial proliferation and infiltration in both vessels, the lumen of each being almost obliterated.

Fig. 3.—Young gumma, highly magnified, showing cell structure and giant cell in center.

Fig. 4.—Miliary gummata in fibrous and muscular tissue.

Chiari has assumed the condition to be circulatory in nature irect syphilis) and due to passive congestions, hemorrhages, etc., hich conditions chronic gastritis of a secondary form are so com- . However, since gummata and more or less ulceration in the ıach are present with the mucosa infiltration, the condition must be looked upon as primary. Simple diffuse syphilitic gastritis out gumma or ulcer does not differ histologically from forms of nic gastritis in which profuse round-cell infiltration of the stomach ›served. But as Hemmeter[2] has pointed out and which I have rved myself on two occasions, the round-cell infiltration is liable : more profuse and general in the glandularis and submucosa, and : collections of them may be seen in the latter and extending ırd into the secreting tissue above it. Such collections of cells e submucosa may appear as gummata and the cell infiltration of glandularis may be pyriform in shape with the base at the sub- ›sa or in fusiform collections above between the tubules. Where ge collection of cells is seen that involves the depth of mucosa, more ss granular and hyaline degeneration of the cellular collection and e loss exists, possibly with the formation of ulcer pits.

The possibility of gastric ulcers of syphilitic origin is still in table grounds in medicine, but there are many reasons to believe such ulcers are a pathological entity. Most all of the cases that been reported are those in which symptoms of ulcer exist in per- who give a past history of syphilis. Simple gastric ulcer and ilis being such common affections, one would naturally hesitate to ciate the two in an individual case. Fenwick has concluded that ne-half of the cases in which the two diseases coexist in the : patient there is no direct relationship between them; in my ion even this is too high a number of cases in so far as syphilis ı etiological factor in the production of ulcer is concerned. While ›usly there is little in the literature in the way of definite associa- between the two conditions, a few cases of distinct luetic gastric · have been reported (Lafleur, Flexner), and there is some sig- ınce in a previous luetic history in the 10 per cent. of Engle's the 20 per cent. of Lang's cases of gastric ulcer.

Exactly how these ulcers are produced is not definitely estab- l, but it is probably by the breaking down of gummata or a d-cell invasion about and in the walls of the blood-vessels and an eration of their caliber, shutting off the blood-supply. Frankel[3] demonstrated this almost pathognomonic change in the blood- ls. In the report of his case in which gummata of the spleen hirty-one syphilitic ulcers of the intestine and thirteen ulcerating

gummata of the stomach were present, he found that encircling the veins were round, oval, and spindle cells, which penetrated the vessel walls, causing a thickening of the coats with a partial or complete obliteration of the lumina. In some veins there existed a localized and narrowing endophlebitis, not infrequently associated with cellular infiltration from without. The arterial walls were also penetrated by similar granulation tissue, the degree of alteration being a lesser one. He also found the same vessel changes in a case of diffuse syphilitic gastritis. The description of the ulcers found in both Lafleur's and Flexner's cases were similar, the special features being that the lesions were soft with overhanging edges, a dry bloodless base, and perigastric adhesions being present. This description follows closely the typical forms of chronic ulcer seen in the aged, which also are most probably due to obliterating blood-vessel change.

Gummata, single and of large size, or coalescing gummata the mass making deposits palpable from without, are no doubt very rare. Of 14 cases collected by Flexner, 5 had positive nodular gummata, one of which was a deposit 8 centimeters in extent. These are generally situated in the pyloric region or along the lesser curvature. They may be seen as circumscribed, elevated, reddish swellings, or flattened elevations occurring in the submucous coat as a dense, compact, soft mass. In the latter instance, the mucosa is thickened, soft, glistening and of a yellowish color, and more or less small-sized ulcerations over them may be noted. On section such masses usually show some fatty degeneration, and even in this instance may be quite firm and whitish on cut surface. In a case in the Krankenhaus Friedrichshain, Berlin, recently reported by Curtis,[4] in which a gastrectomy had been performed, the following were noted. "Pathologic specimens: The resected stomach, preserved in natural condition in Pick's solution, presented a wall which was everywhere somewhat thickened. The mucosa was mammillated, with gastric areas clearly defined and unusually prominent. On the mucous surface of the opened stomach two flat longitudinal elevations were seen. One elevation was 7 centimeters in length, with average width of 2.5 centimeters. It was covered with an ulceration which extended through the mucosa, here and there involving the submucosa. The slightly elevated wall of the ulcer was composed of a series of confluent crescents, and was sharply defined, with vertical margin except for 1 centimeter of its length along the upper border, where it was undermined. The base had a thin, grayish coat, the removal of which laid bare the mottled, fatty-looking submucosa. Except at the margins the ulcer floor was elevated to the level of the uninvolved mucous membrane of the stom-

·cond elevation lay parallel with and beneath the first. It
ly from the brown, plateau-like elevation, 6 centimeters in
? centimeters in width, the end nearer the pylorus being
a small, irregular ulceration. There were no tubercles
·ith the ulcers, nor were they to be found on the corre-
osa. The involved tissue, including the ulcer floor as well
lcerated elevations, had an elastic, rubber-like consistence.
ıugh the thicker portions showed that the increased thick-
tomach wall was due mostly to changes in the submucosa.
examination: Specimens were stained with the following:
ıstic tissue stain, hemalum and eosin, orcein, carbol-fuch-
itrate and pyrogallic acid. The submucosa consisted of
hed cells, with clearly staining nuclei. It was very richly
., in association with the blood-supply, the characteristic
re manifest. There were extensive accumulations of
ınd spindle cells, most numerous in the vicinity of blood-
nd which they formed concentric rings, and, invading the
ts, greatly increased their thickness. In many veins, and
ıumber of arteries, the lumen was entirely occluded, an
being necessary to establish the identity of the vessel. A
ber of vessels on cross-section were free from areolæ of
n the case of those longitudinally cut a part of the course
irely free, with the remainder surrounded by a rich, cellu-
A subendothelial proliferation occurred in some vessels;
as a rule, only a portion of the circumference and took place
of cellular encroachment from without. The richness of
ion prohibited the determination of submucosa and that
e muscular coat adjacent to it contained several accumula-
:helioid cells bearing characteristics of gummata. They
endency to necrosis, small blood-vessels being numerous
ted without. Giant cells with peripheral position of the
ghans's type of giant cells) were found in association, and
ıstances existed also entirely independently. Among the
ıents were numerous eosinophiles and also a goodly num-
ıclear leucocytes. The lymph-vessels were distended with
lymph-follicles were numerous, each supplied with easily
ble large capillaries. In the mucosa and muscular layers,
he persistence of a moderate perivasculitis, and the note-
mulations of epithelioid cells found near the submucosa, no
e manifest. Stains for the spirochæte pallida by Levaditi's
ε negative results. Careful search for tubercle bacilli was
·ative."

escaped observation. Furthermore, it must be
h the acquired form, even when treated the pre-
(three years), that it is not always cured, and
was advanced we had only empirical results
past acquired syphilis, evidences of the
or evidence of such conditions as the
ralysis and other nervous affections,
he tongue, etc., would lead one to
of the digestive disturbances;
ult of the Wassermann test
are the only ways in which
presence of such clinical findings it
or cure certain gastric cases which at first

ings on examination may be mentioned an achylic gas-
t with large amounts of mucus; dilation of the organ with
; a long-standing gastric ulcer in which alcoholism, chlorosis,
rosis, tuberculosis, and other causes can be eliminated, and
es not bleed and has not recovered on the ulcer treatment; a
ed, irregular-shaped, movable, pyloric growth which has
or some time and is not relieved by proper therapy or does
rge and cause the development of the constitutional symptoms
malignant growths do; and a chronically enlarged spleen and
ble left lobe of the liver with abdominal ascites which cannot
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obstinacy to ordinary treatment and their great tendency to
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in the presence of a dilated stomach) when gummata are noted,
r surgery is not advisable until resort to energetic antisyphilitic
ent had first been made. The same holds true in intestinal
is, excepting when marked cicatricial stenosis exists which
s requires operation.

few words must be said on the numerous gastro-intestinal dis-
ces that are seen following treatment by mouth of recently acquired
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ime continuance of the commonly employed caustic salts of
y and possibly also the large doses of iodides can, in most
es, cure the syphilis, but at the expense of leaving a chronic
is from their use. While this is not offered as a general argu-

As a result of the syphilitic lesion, cicatricial thickening in the pyloric region or peripyloric adhesions may occur which would cause obstruction to the normal exit of chyme with resulting gastric dilatation and stagnation.

Enteritis, intestinal gummata and ulceration with consecutive cicatrization and narrowing of the gut may occur, and in long-standing cases with chronic diarrhea and amyloid degeneration of the intestinal mucosa or other organs may be noted. Syphilitic ulceration from mixed infection or the breaking down of gummata with extensive circular ulcers and resulting in marked stenosis is not infrequent. Enlargement of the spleen with gummata in the substance and thickening of the capsule are usually present in syphilis of the liver, and in the latter organ a diffuse interstitial hepatitis, gummata or scarred and botryoid liver, with or without ascites, may exist. Syphilis of course, may also affect the respiratory, renal, circulatory, and nervous systems.

SYMPTOMS AND DIAGNOSIS OF GASTRIC SYPHILIS.

The diagnosis of syphilis of the internal organs is based upon the past history of the initial and secondary symptoms, upon the demonstrations of late syphilitic manifestations, the Wassermann test, and results from specific therapy. The clinical picture as such does not differ in particular ways from non-specific gastric affections, but the results from therapy usually do. There is no question that the more general utilization of the Wassermann test would be most helpful in gastro-intestinal work in the way of recognizing syphilitic from other forms of chronic gastritis, the syphilitic ulcers from the simple form, and gummatous deposits from other formations in the stomach, particularly malignant disease.

Syphilis of the stomach as a clinical condition occurs late in the acquired although it may be met with early in life in the congenital form. Quite naturally, when, with or without the history of initial lesion followed by the secondary symptoms, the Wassermann test is positive and the case recovers on specific treatment; or in the natal form, when the saddle-shaped nose, prominent forehead, striæ about the mouth, Hutchinsonian teeth, disturbances of hearing, history of interstitial keratitis, slender physique, rudimentary beard and scant pubic hair, or the history of many abortions, hydramnios, or giving birth to short-lived infants of a marasmic type is obtained, the diagnosis of internal syphilis is probable or at least suspicious. The benign type of syphilis is even more common in women than in men and here the initial lesion, throat symptoms, roseola, adenopathy, etc.

may have entirely escaped observation. Furthermore, it must be remembered that with the acquired form, even when treated the prescribed length of time (three years), that it is not always cured, and until the Wassermann test was advanced we had only empirical results to go upon. The history of past acquired syphilis, evidences of the congenital type, or the history or evidence of such conditions as the late syphiloderm, tabes, general paralysis and other nervous affections, fissures in the border or dorsum of the tongue, etc., would lead one to consider syphilis as being the cause of the digestive disturbances; whether it is or not depends upon the result of the Wassermann test and that of specific therapy. These are the only ways in which diagnosis is possible, and in the presence of such clinical findings it may be possible to relieve or cure certain gastric cases which at first glance look hopeless.

Of the findings on examination may be mentioned an achylic gastric content with large amounts of mucus; dilation of the organ with stagnation; a long-standing gastric ulcer in which alcoholism, chlorosis, arteriosclerosis, tuberculosis, and other causes can be eliminated, and which does not bleed and has not recovered on the ulcer treatment; a small-sized, irregular-shaped, movable, pyloric growth which has existed for some time and is not relieved by proper therapy or does not enlarge and cause the development of the constitutional symptoms that the malignant growths do; and a chronically enlarged spleen and impalpable left lobe of the liver with abdominal ascites which cannot be accounted for as due to other diseases. Fenwick concludes with syphilitic cases that simulate acute ulcer that they differ in three particulars, the first of which is the extreme severity of pain and vomiting, the second the infrequency of hemorrhage, and the third their obstinacy to ordinary treatment and their great tendency to relapse. An exploratory incision may clear the diagnosis, although (even in the presence of a dilated stomach) when gummata are noted, further surgery is not advisable until resort to energetic antisyphilitic treatment had first been made. The same holds true in intestinal syphilis, excepting when marked cicatricial stenosis exists which always requires operation.

A few words must be said on the numerous gastro-intestinal disturbances that are seen following treatment by mouth of recently acquired syphilis. It is my belief, based upon numerous observations, that the long time continuance of the commonly employed caustic salts of mercury and possibly also the large doses of iodides can, in most instances, cure the syphilis, but at the expense of leaving a chronic gastritis from their use. While this is not offered as a general argu-

ment against the oral administration of these drugs, still, it should b thought of. The gastritis developed is medicinal in causation an in the majority of young and strong individuals clears up to a pra tical extent when the drugs are discontinued. Still, some of the do not, and these may require lavaging, medication and dieting for th purpose. Of late I have come to the belief that in so far as the sto ach is concerned, the safest salt of mercury to employ in a steady w is the mild chloride; better still, however, is the use of inunctions the more recent method of intramuscular injections of either t soluble or insoluble salts. Unless there is special indication for doi so, large-sized doses by mouth in a continued way should not be k up, but rather just enough to keep the patient symptom-free. T average patient does no better in the ultimate cure of the disease the large doses than with the smaller, and it may surprise some to n how much less the factors of anemia and malnutrition, seen in the treatment following the secondary stage, are less or absent. T better state of general body is due to a more normal condition of dig tion left possible by the better gastric condition.

Since the advancement of the Wassermann test of serodiagn of syphilis its value as a diagnostic measure has been learned to be beyond dispute. The Wassermann method, however, is rather c plicated for general utilization in clinical work and has been simpli by a new and simpler method by Noguchi.[5] The latter test diff from the original in the use of an anti-human hemolytic syst instead of the anti-sheep hemolytic system, in being more accur and by the use of the anti-human amboceptor, and complement, a antigen slips which make it simple enough for use in clinical work.

The reagents required for making a test according to Noguch method are: "(1) Anti-human hemolytic amboceptor prepared in r bits by injecting them five or six times into the peritoneal cavity w increasing doses (up to 20 cubic centimeters) of washed human c puscles, allowing five days' interval between each injection. T serum is collected from the immunized animal eight or nine days a the last injection. The titre must be stronger than 0.01 cubic ce meter for complete hemolysis of 1 cubic centimeter of human bl suspension (¼ drop) in the presence of 0.025 of guinea-pigs' fr serum. (2) Complement consisting of fresh guinea-pig serum. Antigen, which is an alcoholic extract of organs or crude preparati of lecithin. This is prepared by extracting 1 part of mashed tis (liver, kidney) in 10 parts of absolute alcohol for several days 37° C., filtered through paper and the filtrate concentrated to ab one-third of its volume, and the fluid preserved. To prepare

ecithin solution for antigen, 0.3 gram is dissolved in 50 cubic centimeters of absolute alcohol and then shaken with 50 cubic centimeters of physiological salt solution and filtered. The filtrate must be clear. (4) Suspension of human corpuscles, prepared by mixing 1 drop of blood of a normal person with 4 cubic centimeters of physiological salt solution. (5) The serum to be tested is obtained by collecting about 10 drops of the patient's blood in a test-tube and using the clear serum that separates from the clot for the test. The reagents No. 1, 2 and 3 are prepared in paper form as follows: No. 1 (anti-human amboceptor). The serum of immune rabbits is taken up with filter paper and quickly dried (a few hours) by a current of air at a low temperature (below 20° C.). If the immune serum is not very strong—the titre 0.01 cubic centimeter, for example—the serum is concentrated by a current of air to one-third of the volume before the paper is impregnated. This is necessary in order to secure a slip of small dimension for convenient use. After complete desiccation the impregnated paper is cut into pieces of equal dimensions, each one being of such a size as to contain 2 units of amboceptor. No. 2 (complement). A rather thick filter paper is impregnated with fresh guinea-pig serum, similarly dried and cut into pieces of equal size. The activity of one slip should possess such an activity as to correspond with that of 0.04 cubic centimeter of the first guinea-pig serum. No. 3 (antigen). The crude preparation of lecithin of known antigenic value is dissolved in ether and similarly taken up into the filter paper. The organ extracts may be used, but must be concentrated in advance as above described. After impregnation and complete desiccation the paper is cut into equal parts, each being of such a size as to contain enough antigen for one tube. The papers when dried can be kept indefinitely at the room temperature in a dry place. Slips of the size of about 5 millimeters by 5 millimeters are used in the tests. These are dropped by means of forceps into test-tubes containing the human blood suspension and patients' serum in the following order and intervals:—

"Six clean test-tubes are employed (size 10 centimeters + 1 centimeter). In the first two place 1 drop from a capillary pipette of the patient's serum which is to be tested. In each of the second two tubes (which serve as controls) put 1 drop of the serum of a syphilitic case known to give the positive reaction. In the third pair of tubes (also controls) put 1 drop of the serum of a normal person. To each one of the six tubes add 1 cubic centimeter of the suspension of human blood-corpuscles and 0.04 of fresh guinea-pig serum as complement. Lastly into one of each of the foregoing pairs of tubes put 1 slip of

the antigen paper; the second tube of each pair receives no antigen. After being well shaken, the six tubes are incubated at 37° C. for one hour, or if a thermostat is not at hand carried for that length of time in a vest pocket. At the end of the incubation add 2 units of anti-human amboceptor to each tube and mix well by shaking. Then incubate for two hours longer at 37° C., following which the reaction is read from time to time during the next ten to twelve hours (tubes kept at room temperature).

"A negative reaction is indicated by complete hemolysis in both tubes irrespective of the presence of the antigen. A positive reaction is shown by complete absence or partial inhibition of hemolysis in the tube containing the antigen and complete hemolysis in the tube containing no antigen.

"Complete hemolysis in the negative control takes place usually within one hour or earlier. When the reaction is strongly positive, as it should be with the positive control set, the tube with the antigen remains free from hemolysis even after a few days standing at room temperature. In such a case the erythrocytes are strongly agglutinated and remain adherent to the bottom of the test-tube, leaving above a perfectly clear medium. In moderately positive cases there is a trace of hemolysis, while the varying degree of positive reaction can readily be measured by the amount of the hemoglobin liberated in the medium and especially by the amount of intact red blood-corpuscles remaining in the fibrin shreds or whitish stroma masses. It should be mentioned that the tubes containing the antigen undergo hemolysis somewhat more slowly than those without the antigen, but complete hemolysis must occur in both tubes of the negative control set before the reaction of the other sets is read. It is also necessary to note that every tube without antigen, irrespective of the nature of the specimen of blood-serum therein contained, must undergo complete, or at least almost complete, hemolysis before the final reading of the reaction is made. In instances in which tubes without antigen do not undergo hemolysis the test must be repeated with a smaller quantity of the human serum in order to obtain a definite result."

Noguchi summarizes the results of the two methods (Wassermann's fluid, and Noguchi fluid and slips) as follows:—

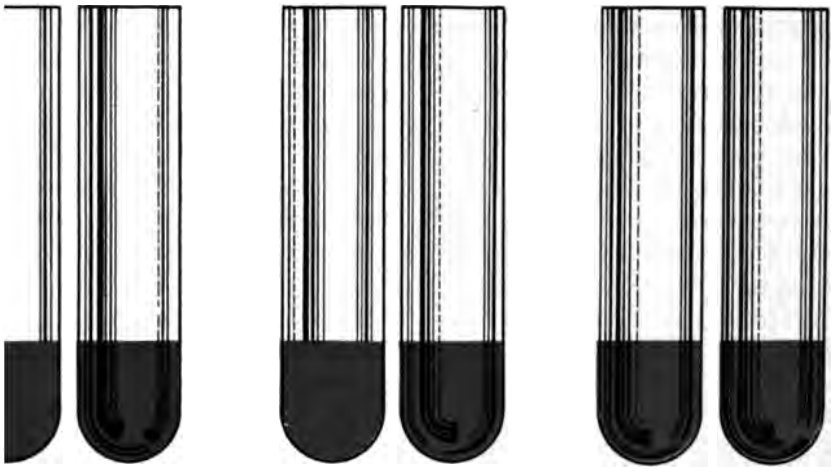
"Of 7 cases of primary syphilis the Wassermann test was positive in 5, the present test in all.

"Of 27 cases of manifest secondary syphilis the Wassermann test was positive in 23, the present method in all.

"Of 12 cases of latent secondary syphilis the Wassermann test was positive in 6, the present method in 9.

PLATE LII.

POSITIVE REACTION.



1 2 3 4 5 6

Noguchi's Modification of the Wassermann Test.

TIENT'S SERUM.

each of the tubes
drop of serum, 1
suspension of human
rpuscles and 0.04 of
uinea-pig serum as
nent, one slip of the
paper in No. 1 and
No. 2, to each tube
units of antihuman
tor.

IVE REACTION, an
or very incomplete
is in No. 1 and
e in No. 2.

KNOWN SYPHILITIC SERUM.

Into each tube put one drop of serum, 1 c.c. of suspension of human blood-corpuscles and 0.04 of fresh guinea-pig serum as complement, one slip of antigen paper in No. 3 and not in No. 4, into each tube add two units of antihuman amboceptor.

POSITIVE REACTION, an absence or very incomplete hemolysis in No. 3 and complete in No. 4.

KNOWN NORMAL SERUM.

Into each tube put one drop of serum, 1 c.c. of suspension of human blood-corpuscles and 0.04 of fresh guinea-pig serum as complement, one slip of antigen paper in No. 5 and not in No. 6, into each tube add two units of antihuman amboceptor.

RESULT, complete hemolysis in both tubes irrespective of the presence of antigen.

"Of 18 cases of manifest tertiary syphilis the two methods agreed were positive in 17.

"Of 18 cases of latent tertiary syphilis the Wassermann test was tive in 11, the present method in 14.

"Of 11 untabulated cases of tabes dorsalis only 3 were positive ı the Wassermann test and all were positive with the present test.

"Of 28 cases suspected of syphilis or of syphilitic origin, the ssermann test was positive in 16, the present method in 21.

"The results obtained by the paper method were perfectly reliable satisfactory. Cases which were negative to the Wassermann and kly or often quite strongly positive to the present method were with."

TREATMENT.

When there is reason to believe that syphilis of the internal organs :s the treatment should be energetic, simply because the internal ifestations are serious disorders. When the diagnosis is doubtful 'hen the so-called therapeutic test is to be tried, lesser quantities ıercury and the iodides may be sufficient in the beginning. The · of the protiodide and bichloride may be given by ingestion for a t time, but when benefit is being derived they should be adminis-1 by injection or inunctions. The hypodermic use of from 10 to 30 ms of a 0.4 per cent. biniodide in olive-oil, or 10 minims of a 10 per mercury salicylate in albolene, either injections given every third ɔurth day are efficient. Calomel by mouth (0.065) with a small of powdered opium (0.02) taken three times a day is the most ·ficial and safe combination for oral use in gastric syphilis, both to the case and relieve the local symptoms; it is best given in dered form.

As internal syphilis in the adult is seen mostly as late tertiary ifestations, the iodides should be given. The power of the drug issolve luetic tumors is little short of miraculous. The iodides in erate-sized doses being better tolerated by the stomach than the cury salts, they may be administered by mouth preferably in solu-

The quantity given should be between 2 and 4 grammes (30 60 grains) daily and at meal times. When in a gastric case fit is being derived, the daily quantity should be gradually increased 0 or more grammes until the symptoms abate, after which the drug ɔntinued at about the first mentioned quantity or less. Potassium le in saturated solution (1:1) is the most convenient form to loy, and this may be given in milk or essence of pepsin. The popular ıula of mixed treatment may be used, but it is usually better in

abdominal syphilis to use the insoluble mercury salts (calomel, biniodide) alone and to administer the iodides in increasing doses as may be indicated. The auxiliary treatments, such as dieting, tonics and hygiene should receive attention.

TUBERCULOSIS.

ETIOLOGY.

The first light on the true etiology of tuberculosis was shed by Villemin in 1865 in a communication in which he proved that the disease was a specific affection, that it had its origin in an inoculable agent, and that it could be inoculated from man to rabbits. Following this, much work was done by many experimenters but it remained for Koch to demonstrate the existence of the tubercule bacillus as the specific cause of the disease.

The tubercle bacillus is a minute colorless rod with rounded ends, and in length about one-fifth the diameter of a red blood-cell. Its most striking peculiarity distinguishing it from other bacteria is its power to hold aniline dyes in spite of exposure to acids ("acid fast"). The human type is longer than the bovine and grows more readily on all media, producing higher acidity in broth culture. It is resisting to temperatures, the lowest temperature for destruction being 55° C. (131° F.) of moist heat acting for a period of six hours; dry heat is borne to 100° C. for an hour without killing the bacillus. The tubercle bacillus is not destroyed by any degree of cold. They can, however, be destroyed by the normal gastric juice in a test-tube and this result is due to the hydrochloric acid and not to the enzymes. Under natural conditions in the living stomach, because of the short stay, the varying amounts of acid in different stomachs, and their mixture with food, there is little likelihood that all of the bacilli are killed. The paths of infection are three: inoculation of skin and mucous membrane surfaces, the pulmonary alveoli and by ingestion. Varying views as to the frequency in which the disease is contracted through the different paths of infection are held, most observers agreeing, however, that infected milk holds the most prominent place in the disease of infants and children, and infection by dust depositing upon the upper air-passages, and infected foods, the organisms gaining entrance through the mucous membranes of the digestive canal, being the most important in adults. Foci of tubercular infections may exist in latent form in any tissue of the body and under conditions of lowered general or local resistance may become active with extensive local, other tissue or general involvement. It has been computed that 50 per cent. of the

ıeral population acquire an actual implantation of tubercle bacilli at ne time during life.

PATHOLOGY.

The action of the tubercle bacillus on the tissues in its essentials is ıilar to that of most infectious agents. It is inflammatory in nature, l the most characteristic result is the formation of minute grayish l translucent nodules of firm consistence called the miliary tubercles. ch nodules vary much in size, some being too small to recognize th the unaided eye and others again being quite apparent. In a ɔrt time after formation the tubercles lose their translucent char- ter in the center with the formation of a grayish or yellowish-white acity, the beginning of the ultimate necrosis or caseation.

Microscopically, a miliary tubercle is composed of a concentric ass of cells having a long, oval and vesicular nuclei. Among the lls which make up the mass of the tubercle, especially at the outer ɔrtion of the nodule, may be seen numbers of relatively smaller cells ith large nuclei, and at the poles of the protoplasmic mass the well- ıown giant cells described by Langhans and Schuppel. These latter e irregular in shape and are provided with a number of nuclei, some- nes as many as twenty in number. The tubercle bacillus can usually demonstrated in the tubercle. Other tuberculous formations occur ıich are more exudative or acutely inflammative in nature, and in gastro-intestinal tract ulceration of mucous membrane is the rule. tissue of the body is exempt from involvement, but in this connec- n only that of the salivary glands, the mouth, esophagus, stomach, estines, pancreas, liver, and gall-bladder will be considered.

Of late, tuberculosis of the salivary glands has been shown to be a uncommon affection. The parotid is most frequently affected and submaxillary less often. These glands in infections by way of the ıeral blood-stream may become the seat of miliary tubercles, or the ease may occur by infections from the mouth by way of the gland cts. The pathological change noted in most cases is a diffuse form h caseous infiltration, softening and scarring, or as a focal lesion ming a caseous isolated nodule. Unless the gland is extensively ltrated by the lesion, the secretory function is not interfered with. ɔm the mouth infections the condition is usually unilateral, and ıteral in those from the blood-stream.

Tuberculosis of the mouth generally manifests itself in the tongue. is a rare affection and usually due to direct inoculation by tuber- osis sputum. The disease appears as submucous nodules (tuber- omas) which in time ulcerate. The nodules may be single or

multiple, and may remain stationary for a long time. When ulceration has taken place they are inclined to be painful and miliary tubercles may be noted at the margins of the shallow ulcers. Tuberculosis may also appear on the flesh of the gums or on the soft palate.

Tuberculosis of the esophagus is surprisingly rare when one considers the commonness of pulmonary tuberculosis in which the swallowing of infected sputum and food always exists, and the liability of injuries from food in the mucous membrane of the gullet. Inoculation may occur directly by the swallowed bacilli finding lodgment upon the mucosa, or indirectly by extension from bronchial lymph-nodes, trachea, vertebræ or even the lungs. In miliary tuberculosis it may also be the seat of numerous tubercles. As a rule it is an affection of the esophagus found late in the history of chest disease, and the lesion is mostly ulcerative in character. Thus, in a tuberculous patient of an advanced type, when severe pain on swallowing exists and laryngeal involvement can be excluded the condition should be thought of. In the cases that recover from the tubercular conditions a stenosis of the gullet from cicatricial contraction may be left.

Tuberculous ulcers of the stomach are comparatively rare, they being found in about 2.3 per cent. of autopsies upon tuberculous patients. Several reasons for this rarity have been advanced, the most tenable being that more or less of the bacteria are destroyed by the gastric juice and that unless there is a pyloric lesion lowering the local resistance at that site the bacteria are prevented from settling and growing in the mucosa. Added to these Barchasch[6] has drawn attention to the scarcity of lymphatic follicles in the stomach walls and the motility of the organ which insure a comparatively short exposure to infection. Consequently, motor insufficiency and chronic gastric catarrh, particularly gastritis granulosa, in which there is an increase in the lymphoid follicles, are among the most important predisposing factors to the establishment of a tuberculous process. Although gastric involvement is usually secondary to pulmonary disease and occurs as the result of the constant swallowing of infected sputum, a number of cases of primary gastric tuberculosis have been reported. Martin states, "Perhaps 20 per cent. of patients with ulcer die of tuberculosis and in 6 out of 22 fatal open ulcer cases in Montreal pulmonary tuberculosis existed, but in over one-half of these it had no relation to the cause of death. Five anatomic varieties of tuberculosis of the stomach have been described. (*a*) The ulcer, sometimes single, ofttimes multiple, which are rather small, with irregular outline, elevated, somewhat undermined, with indurated margins and rough base, and in which tubercles may be noted. On the other hand in rare instances, such an

:er may be small and deep, eroding a large vessel. (*b*) Miliary ›erculosis, due to the tubercle bacilli gaining the blood-stream and : dissemination of the organisms throughout the body and their position in the various internal organs in which they form tubercles. ıese may be noted in the stomach as small millet seed formations on e peritoneal surface or along the paths of the vessels in the stomach ılls. (*c*) Solitary tubercles which are exceedingly rare and probably ıe to local infection from infected sputum. They are found in the omach walls. (*d*) Tumor-like masses, usually in the pyloric region, hich very closely simulate carcinoma. Such formations are usually ue to large tubercular deposits, perhaps adenomatous, with an extent f connective tissue in addition. As the pylorus is more richly sup-lied with lymphoid tissues than any other portion of the stomach it ; not unlikely that a number of cases of inexplicable stenosis are uberculous in origin. (*e*) Tuberculous cicatricial pyloric stenosis rom more or less healed lesions or contractions of perigastric bands ue to them."

Intestinal tuberculosis is the most frequent of all complications of hronic pulmonary tuberculosis. It occurs in various forms, the com-ıonest of which are areas of concentric hypertrophy, stenosing or eforming cicatrices, and tumor formations resembling malignant rowths. Tubercles may also be found in the rectum, pancreas, liver nd gall-bladder. In the latter instance gall-stones are usually also resent. Tuberculosis of the liver, although a common affection, is ırely diagnosed during life, and that of the gall-bladder practically ever. If ulceration and subsequent stenosis of the rectum takes lace diagnosis is possible, although most of these lesions are simple, ıalignant or syphilitic in nature.

SYMPTOMS AND DIAGNOSIS OF GASTRIC TUBERCULOSIS.

A gastric ulcer which persists in giving symptoms after a full urse of the Leube or Lenhartz rest cure is in nature either tuber-lous, syphilitic, malignant, or the chronic form of ulcer accompany-ɜ senile vascular change. There are no distinct symptoms of gastric ›erculosis, excepting possibly the chronicity of the ulcer course and, e the syphilitic ulcers, they are not so liable to bleed as the simple, lignant or the chronic forms. Naturally, in an ulcer case if evidence tubercular disease exists in other portions of the body than the domen, one should think of the lesion in the stomach being tuber-lous in nature. In gastric ulcer of a tuberculous character the pain liable to be of a severe character.

If stenosis of the pylorus exists and a tumor is palpable one must think of local tuberculosis as well as malignant disease. Often at operation a mass which is impossible to remove or explore may be present in the post-pyloric region and thus diagnosis of its character would not be possible. It should not be forgotten that primary atony of the stomach may secondarily follow other infectious diseases, such as typhoid fever and tuberculosis, and that most instances of dilated stomachs in these diseases must be considered as a result of the toxemia and subnutrition rather than the result of local gastric affection. The finding of tubercle bacilli in the gastric contents serves to no diagnostic purpose, because they are usually swallowed in the sputum or with the food and drink.

There is little to be said in any definite way concerning gastric tuberculosis, but matters pertaining to the diagnosis of tuberculosis in general may serve of importance in individual cases. Among these are, the persistent, slight elevation of temperature without apparent cause and with its highest point about 4 o'clock afternoons; a steady loss in weight and strength; the chest symptoms of cough, hemoptysis, dyspnea, pleurisy, the examination of the sputum and the physical signs; and the tuberculin test.

In unhealing ulcers of the stomach or intestines the tuberculin test offers the only possibility of diagnosis. Doses of tuberculin prepared, according to Koch's directions and standardized, in ascending quantities of 0.001, 0.003, 0.005, 0.008 and 0.01 cubic centimeter, well diluted, should be given. The reaction of temperature rise (37.8° C. or 100° F. or more) should be sought for from eight to twenty hours after the injection and at intervals for seventy-two hours afterward. If the patient fails to react on one quantity the next larger-sized dose should be given until several doses have been administered. In addition to the first mentioned being a dangerous method of diagnosis, and neither of them being as efficient tests as the Koch tuberculin injection, the recently advanced ophthalmic and the von Pirquet tests are destined to only historical interest in medicine.

TREATMENT.

It must be plain from what has already been stated concerning gastric tuberculosis and the great dangers of intestinal complications, that cases of pulmonary tuberculosis should be warned against swallowing sputum, and advice should be given to thoroughly cleanse the mouth and fauces before eating and drinking. There is nothing special to be added concerning the medical treatment of tubercular affections of the abdominal organs to what has already so universally

been advanced on the treatment of this broadcast disease. The far-reaching medical propaganda against tuberculosis has instilled thoughts of its dangers in the minds of the intelligent and thinking public. The continuation of the modern hygienic and dietetic principles of prophylaxis and treatment, the isolation of patients, and their instruction and observance of the dangers of carelessness in handling infective discharges will eventually bring tuberculosis into the category of the rare diseases. In no one field of medicine is the profession now serving the public so well. The elimination of tropical disease is of course important, but it is in the work being done against this so-called "house disease" that the greatest degree of medical service is now being rendered.

Because of the seriousness of abdominal tuberculosis it seems justifiable to use tuberculin for therapeutic purposes. But tuberculin is a most powerful agent and demands the greatest care in its administration. Only the slowest increase in dosage should ever be employed, and the slightest untoward departure of the patient from the usual course should be seriously considered. It should only be used in the afebrile cases and when the state of general nutrition permits. The dose should be begun at 0.0001 or, better, 0.00001 cubic centimeter of the O. T. form, given every third day, and gradually increased until the tolerance is reached. The B. F. form has been advised for the febrile cases. The treatment should be continued for at least three months, and the hygienic-dietetic treatment faithfully followed throughout the course.

In a chronically persistent localized lesion in the stomach surgery may be justifiable. In the case of a persistent gastric ulcer in which the Wassermann test for syphilis is negative and the tuberculin test positive resort should be made to the general medical treatment of tuberculosis, and in failure with these, providing the general condition of the patient warrants surgical procedure, operation should be performed. In the instances at operation in which such an ulcer would be noted or suspected, excision is the operation of choice. Obviously, the drainage operations would offer little in the way of substantial benefit.

REFERENCES.

1 CHIARI: "Festschrift für Rudolph Virchow," 1891, Bd. ii, p. 297.
2 HEMMETER: "Diseases of the Stomach," p. 597.
3 FRAENKEL: Eugen. Virchow's Arch. f. Path. u. Path. Anat., 1899, civ; Münchener med. Wochenschr., 1901.
4 CURTIS: Journal of the American Medical Association, April 10, 1909.
5 NOGUCHI: Journal of Experimental Medicine, vol. ii, No. 2, March, 1909.
6 BARCHASCH: Beit. z. Klin. d. Tuberculose, vii, part iii, 1907.
7 MARTIN: Osler's "Modern Medicine," vol. v., p. 181.

CONGENITAL STENOSIS OF THE PYLORUS.

As a rule, instances of congenital stenosis of the pylorus are only in infancy and childhood, although there is no doubt that a of the cases of true congenital stenosis pass on to adult years. I very young it is also probable that pylorospasm without demonst tissue atresia can exist and in contra-distinction these have been d nated as congenital spasm of the pylorus. The first authentic of the condition was described by Beardsly (1788), after whic disorder did not receive much recognition until the publicati Landerer in 1879, and that of Maier in 1885. Since the latter numerous instances of true pyloric stenosis occurring in infancy been reported in which at autopsy thickening of the general p tissues and tumor formation due to thickening of the longitudina circular fibers at that site were noted.

SYMPTOMS AND DIAGNOSIS.

In cases of both congenital stenosis and pylorospasm the i are born apparently well, and evidences of the condition do not a until from one to four days or even as late as eight weeks delivery. The first symptom that usually directs attention to th dition is more or less vomiting which at first occurs at int throughout the twenty-four hours and soon becomes persisten infant rejecting more or less of the milk after each nursing. In of the cases the ejection from the stomach is larger in quantity t

Since ordinarily the great majority of infants are breast-fed, par-
larly in their early days (the literature shows that fully two-thirds
:hese infants have been breast-fed from the start), the onset of
iiting without cause and which does not respond to dietetic and
lical measures and soon becomes a marked feature in the case
uld immediately awaken suspicion of the presence of the condition.
those who are bottle-fed a greater element of doubt in the diagnosis
ally exists simply because a number of infants do not respond suc-
sfully to the generally accepted percentage feeding for that age,
l also because so little time is allowed to experiment with the food
ore the symptoms of stenosis have developed. In almost every
e of the latter, and certainly in the most common fatal ones, the
sistency of vomiting in face of the simplest feedings usually soon
gests the diagnosis. With the vomiting there are other signs of
istitutional disturbance. Among these are evidences of pain and
tlessness after each nursing, and constipation, or the movements
small, sometimes fluid in consistency, and may be greenish in color.
ahim has described singultus in these cases and also eructations of
; the latter, however, are not important since they are also common
healthy breast-fed infants. There is no fever.

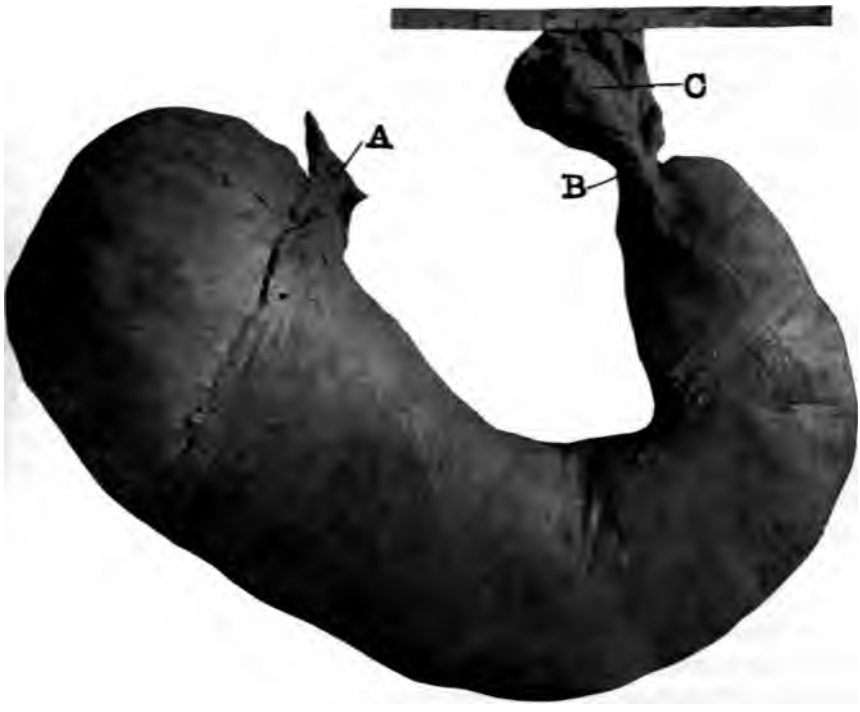
Physical examination in the majority of instances shows a charac-
istic condition of the surface of the abdomen. On the intro-
tion of food a gastric peristalsis is usually visible running from
left costal border, passing forward to Traube's triangle and
pping in a sort of groove. A second wave of peristalsis is taken up
this latter-mentioned point passing onward beyond the ensiform
tilage and then disappearing downward. Just before ejection of its
ntents, the stomach may be seen to erect itself in extreme peristalsis,
ntracting again just before vomiting takes place. On careful exam-
tion during this period a small, hard nodule beneath the border of
liver running downward toward the umbilicus may be felt; this
resents the pyloric end of the stomach. In some cases and par-
ularly in the spasm ones, the described peristaltic movements may
be observed and the pylorus not be palpable or if so only indis-
tly and to be noted only at the times of vomiting and not when
organ is empty; these facts are of great clinical importance in
arating the case of simple spasm from those of organic pyloric
osis. In other cases again which first appear clinically as
ances of spasm, distinct gastric peristalsis might be noted when a
siderable degree of emaciation has set in.

Most valuable in this connection are the remarks of Koplik[1] who
lertook to reconcile the conflicting theories of this condition to be

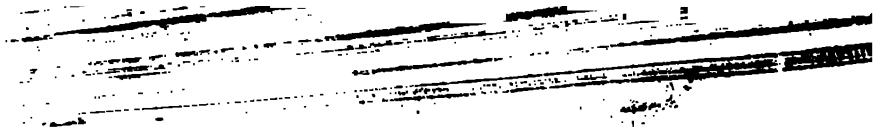
found in literature in the following matter: "I will take up the question as to whether in these cases there is a spasm or a distinct stricture of the pylorus or stenosis. I believe that there is a set of these cases, the subsequent history of which proves distinctly that there is at a certain period of the illness a spasm of the pylorus and stomach at its pyloric end; that for certain reasons this spasm subsides and under favorable conditions the children cease to exhibit further symptoms of their condition, and recover. In other cases, in addition to this spasm of the pylorus there is added also a distinct anatomical condition in which the structure of the pylorus is abnormal; the muscular coats as well as the mucous membrane are thickened and thrown into folds, causing a narrowing of the orifice of the pylorus. This, with the spasm superadded, causes a distinct stricture at this point, which in some cases is extreme. In a great many cases, even this anatomical condition sometimes admits of improvement by relaxation of the stricture, cessation of the spastic condition at the pyloric end of the stomach and opening up of the lumen of the pylorus, and a continued improvement of the patient. In other cases this spasm of the pylorus may subside, but the lumen of the pylorus remains narrow and still the children may improve with correct diet. In other words, if the anatomical condition of narrowing of the pylorus is not complicated any longer with a spasm, which exaggerates this condition, a certain amount of food is allowed to pass through the narrow orifice into the intestine, is absorbed, and the children improve."

What is especially interesting here are the instances of the condition that go on to adult life. Landerer described some autopsies in adult subjects who had lived until the forties which showed at post mortem a narrowing of the pyloric orifice. Of such the author has seen two, one in a male of forty-three, the other in a female of twenty-seven, both of whom died of diseases referable to other organs than the stomach. Although, as in Landerer's cases, these two subjects had suffered from infancy and during all of adult life from the effects of this stenosis, the condition was not suspected and only disclosed at autopsy. The one organ (Plate LIII) was the largest stomach and also the largest of uniform shape that I have ever seen. Sections of parts of the organ showed a perfectly normal condition of the walls, excepting that the musculature was very highly developed in a general manner throughout. The diagnosis of these adult cases is very rarely made, not because diagnosis is so difficult but because the condition is rarely thought of. The diagnosis when made is usually arrived at by the noting of a very large sized, uniform-shaped stomach in good position strongly suggesting megalogastrica. In the latter, however,

PLATE LIII.



Markedly dilated stomach due to congenital stenosis of the pylorus. The size of the specimen shows the possibilities to which a stomach may dilate. The organ measured in its long axis nineteen and one-half inches, and thirteen and one-half inches in circumference at its widest part. *A*, Cardia. *B*, Pylorus. *C*, Duodenum. The measure is an inch scale. Adult case.



in the exit of food is not the rule and thus the mixed-meal
f examination for noting motility or patency of the pylorus
ve to separate the two conditions. Furthermore, an X-ray
ken so as to bring the pyloric region distinctly into view
most helpful. From simple atony or dilatation no difficulty
countered, because in atony the organ is never so large in
uniform in shape, is liable to be more or less prolapsed, and
of cause is usually obtainable. Of course, a most valuable
he diagnosis is the history of digestive disturbance since
r in dilated stomachs accompanying benign pyloric stenosis
tainable the history of health up to a definite time, usually
ighteenth year of life.

TREATMENT.

ases of infants in which the symptoms come on a few days
and are intense are most often quickly fatal. Still, in the
whether the cause of the condition is a simple pylorospasm,
n added to an originally narrowed orifice, or the existence
ice which is not occluded to such an extent that nutrition
sible, makes it incumbent to institute careful treatment with
purpose of minimizing the element of spasm and nourishing
. The adult cases, in my opinion, are always operable ones
the symptoms of distress cannot be held down by dieting,
ient chafes under the long, strict régime. The operations of
uld be pylorectomy or the pyloroplastic operations.

ants the dietetic treatment is the most important. Breast
ould be kept up but the amount of milk the infant suckles
severely controlled, effort being made to keep it short of the
of the child to vomit; the feeding also should be at long
(every four hours or more). It may be advisable to even
e the breast feeding and employ a substitute feeding for the
g, firstly, because not every breast milk of a mother seems to
d to her infant, and secondly, it may be advisable to keep
elements of mechanical irritation of the milk curds as well as
lty of their going through (even the casein flocculi of
nilk). For these reasons a well-strained fluid, like vegetable
roths, or sweetened water might answer to tide the case
pasm. To these feeding, Koplik adds a little citrate of soda
temporary benefit from its use. The substitute feedings
be given in small amounts and at long intervals.

applications [illegible] may be made to the
and enemas [illegible] of normal saline solu-

Although the pediatrist mentioned reports 1 case of congenital
trophic stenosis of the pylorus in which operation seemed to s
signal benefit, he states: "An operation such as is proposed
relief of congenital hypertrophic stenosis of the pylorus presu
great technical skill on the part of the surgeon, and great de
and rapidity. One surgeon may complete the operation of pc
gastroenterostomy in fifteen minutes, another in forty-five m
The difference to the patient can better be imagined than des
Again, a mortality of 50 per cent. (Ibrahim) to 75 per cent.
tainly not an encouraging prospect for the physician to hold up
anxious parents. We are asked to hand these cases to the s
before it is too late. Who will say, and how are we to dec
proper moments when all further attempts to save the patient
hopeless. I confess, with all my experience with these condit
still feel that my chances with nature are as good, if not in som
better, than with the operative measure. There is anothe
which I especially wish to consider, and that is, that the cutti
of a portion of the gut, which results when posterior gastroe
tomy is performed, is not without harmful influence. The infa
has been recorded in this paper as having been successfully o
upon, did very well up to the eighteenth month of life, and pr
no symptoms referable to the operation. He has, however,
shown an anemia which does not yield to treatment, a rachitis
marked degree, and is late in its development. He presents a
spiratory apnea and, what is most peculiar and especially interes
the surgeons, symptoms which point to a narrowing of the a

CONGENITAL ABNORMALITIES IN THE SIZE OF THE STOMACH.

Even in health the capacity of the human stomach varies within wide limits, but this is most marked in the pathological conditions. Ziemssen, as a result of a large number of post-mortem examinations on persons of about the same size who, during life, had never manifested signs of digestive disturbance, found that the largest stomach held 1680 cubic centimeters (56 ounces), the smallest 250 cubic centimeters (8 ounces), the other figures running between these two. To Ewald belongs the credit of first pointing out that the stomach no matter how great its capacity may still functionate properly. To such a congenitally, or for dietetic reasons, acquired large stomach with normal functions the term megalogastrica is given, and this type of organ must be distinguished clinically from the dilated organ, also with large-sized cavity, but which is accompanied with digestive disturbance. In megalogastrica the organ is capable of propelling its contents at the proper time, and that is the main diagnostic point between these two types of large stomachs—that is the normal and the pathologically dilated. The instances of megalogastrica are usually discovered by accident and by X-ray because no symptoms are present bringing the individual under clinical observation, and the motor tests are usually normal.

On the other hand a few instances of very small sized normal stomachs have been noted. The term angustatio ventriculi, however, refers more particularly to the stomach, which, because of esophageal or cardiac stenosis, has not received bulk enough of food at each meal over running times to have it maintain its regular size, or because of severe contractured change in the walls of the organ (diffuse hard cancer, cirrhotic gastritis) has caused a diminution in its size. Of the cirrhotic type described by the French a perfect example is shown in Chapter XIX. Extra-gastric tumors pressing upon the stomach could cause a relative diminution in the size of the cavity of the organ, and the most common of these are the instances of very large spleen pressing upon the fundic end and omental or pancreatic growths.

The diagnosis of both the large and small stomach can be made by noting the quantities of fluid that may be instilled into the organ, or, better still, by the bismuth X-ray method of examination.

TRANSPOSED ABDOMINAL VISCERA.

The stomach may be found in an abnormal position, either by congenital malposition, or pathologically, such as in cases of prolapse or deformities due to the contraction of perigastric bands or large-sized growths pressing the organ out of normal location. Among the congenital abnormalities are the very rare instances of partial or complete defect of the diaphragm in which the stomach may be situated on the right side of the abdomen (pylorus to the left) and the liver on left side.

GASTRIC TETANY.

Because of its seriousness, tetany is worthy of special mention. Although the condition is usually a symptom of gastrectases (generally following old scarred ulcers), still, it may occur without any such complication—in fact with no assignable pathological cause of any kind.

Attention was first drawn to tetany by Morgagni, and it was first described in clinical detail by Newman in 1861. Since that time a number of cases have been reported, and numerous theories as to the cause of the symptoms have been advanced. The majority of authors adhere to the intoxication theory and regard tetany as the consequence of an intoxication of the organism with abnormal products of metabolism from the diseased gastro-intestinal canal; as to this, the theory of Martin[2] (and also Gerhardt) that the condition is probably induced by the absorption of some soluble poison which is unneutralized in the stomach is interesting. Kussmaul regarded it as due to dehydration of the tissues, particularly the nerves and muscles, on the analogy of the occurrence of cramps in Aciatic cholera; this belief, however, does not seem warrantable. Germain Sée held to the theory of reflex action from stimulation of the sensory nerves of the stomach, a not unreasonable theory when one considers that tetanic seizures may be precipitated by lavage, be present in cases of severe vomiting, and in intestinal parasites, and particularly that the twitchings may stop when lavaging is discontinued, vomiting controlled, or the parasites have been removed. However, it is most probable in the adult cases that the theory of Bouveret and Devic[3] of autointoxication from prolonged action of abnormal processes of digestion is the most reasonable one. The main reasons for this are the isolation of a substance resembling peptotoxin which when injected into animals causes general convulsions, the fact that acetone is commonly found in the stomachs of these patients, and also increased indican in the urine.

SYMPTOMS AND DIAGNOSIS.

This peculiar symptom-complex is caused by the hyperirri-
bility of certain peripheral nerves, usually the facial and those which
nervate the extensors of the extremities. All degrees of seizures are
ɔted from slight facial twitchings, intermittent tonic muscular spasms
the hands and arms or feet and legs, to severe types of convulsions
ith unconsciousness. The contractures may involve only the neck
calf muscles, and in severe cases are always quite painful. The
ɔasms are generally bilateral, and when well marked begin in the
ngers and toes, and advancing to the flexor muscles (the extensors
ıly slightly) bend the elbows and knees. The onset of the convul-
on is usually sudden, beginning with sensory disturbances in the
ınds and feet which are soon followed by spasms of the distal flexor
uscles extending rapidly to the muscles of the extremities of the
ɔdy. The slightest convulsive phenomena are those of creeping
umbness, formication, and slight tonic contractions, located par-
cularly in the hand or face. Slight symptoms may be present for a
ng time without classical convulsions, or they may immediately pre-
de a typical attack of generalized convulsion. The pathognomonic
gn of tetany convulsions, which differentiates it from convulsions
ıe to other causes, is the fact that some of them can be reproduced by
echanical or electrical stimulus during the interval between the
tacks. The mechanical superirritability of the facial nerve is
idenced by contraction of the muscles supplied by the individual
anch of this nerve irritated by tapping. Mechanical irritability of
e nerves of the upper extremity is shown by typical contracture of
e hand and forearm being produced by constricting the arm. This
rown and Engelbach attribute to venous congestion since they noted
at it came on slowly. The duration of the attacks varies from five
inutes to several hours, and when prolonged may terminate in death.
he fatal cases are those in which the muscles of the larynx and tongue
e involved with those of the general body.

Fortunately, tetany is not among the frequent sequels of dilata-
ɔn, and its presence when pyloric stenosis exists rather argues
ainst malignant disease, although it has been noted in cancer in
hich there was an absence of HCl secretion and high degrees of lactic
id fermentation present. Usually, however, the stomach analysis
ıows large amounts of hydrochloric acid together with marked
egrees of stagnation and accumulation of foods and fluids—pyloric
enosis of the benign type—this is the form in which acetone and sul-
ıurated hydrogen may be found in the gastric contents. The diag-
ɔsis usually lies between epileptiform attacks and the habit spasms.

The prognosis of tetany is always grave, the cases collected by Bouveret and Devic showing a mortality of 70 per cent. and those mentioned by Albu 31 deaths in 40 cases. The prognosis in those who have successfully passed through attacks must be guarded, because the seizures are liable to recur even after lapses of time. According to Brown and Engelbach, the mortality under medical treatment has been 88 per cent.; but since the introduction of surgical treatment, it has been reduced to 37.5 per cent. The prognosis of the individual cases necessarily depends upon the nature of the lesions producing the obstruction of the pylorus, and in these cases most all of these are benign.

TREATMENT.

The one efficacious method of treatment is the surgical one and the performing of a gastro-enterostomy for the purpose of providing better drainage of the stomach. Manifestly, in dealing with so serious a condition and one which is always liable to return unless this drainage had been established, the patient's chances for life and comfort are very much better after operation than when temporizing with medical measures. I believe that surgery should in all cases have first consideration, because the number in which a severe pathological condition of the stomach is not encountered are exceedingly few and should never be figured in the choice as to the desirable method of treatment to institute, namely, medical or surgical. In the light cases when the stomach does not show evidences of dilatation and stagnation the medical treatments of careful dieting and lavage may be tried for a short time, but even in these, surgical exploration at least should not be delayed too long. During the seizures the bromides or chloral by rectum or possibly morphine hypodermically may be employed, and when the convulsions are intense chloroform by inhalation may control the epileptiform attacks for the time being until operation can be performed. Chvostek lays stress on profuse rinsing of the stomach, stopping feeding by mouth, and copious saline infusions as first indications for medical treatment. Should the stomach-tube be used, it should be introduced very cautiously or the manipulations may aggravate the spasms. Rest in bed, equable warmth, tepid baths and sweating procedures are good supplemental measures. The intravenous administration of calcium in the form of calcium lactate may control the spasms.

References.

[1] Koplik: American Journal of the Medical Sciences, July, 1908
[2] Martin: Osler's "Modern Medicine," vol. v, p. 291.
[3] Bouveret and Devic: Revue de méd., 1892, p. 38.

CHAPTER XXVI.

Congenital Defects of the Stomach.

(*Continued.*)

SPLANCHNOPTOSIA.

PRELIMINARY REMARKS.

ALTHOUGH Aberle, Rollet and Oppoltzer presented views of lanchnoptosia, J. B. Morgagni (Italian, 1682-1771) was among the st to describe the anatomy of this disorder. Virchow[1] drew definite tention to the dislocation of viscera by peritonitis and to assign rious digestive symptoms to them, but it remained for Frantz Glend, thirty-two years afterward in his admirable work "Des Ptoses iscerales Diagnostie et Nosographie (enderoptosie-hepatisme)" to esent the subject as a clinical entity of the scope and importance at it deserved. Since that publication numerous clinicians have lded to the understanding of the subject, among the most notable of hom were Kussmaul, who drew definite attention to gastroptosis; ndau, whose interesting works, "Wander Niere" (wandering kidy) and "Wander Leber" (wandering liver), and the writings on the st-puerperal types of splanchnoptosia added much to the practical le of the subject, and also Czerney, Keher, Martin, Schröder, Stiller, wald, Kuttner, Fleiner, Curschinaun, Kelling, Meinert, Langerhans, rauss and others.

Beginning about twenty years ago the medical profession became gnizant of the commonness of these conditions. Before that ne displacement of the viscera was regarded as a rarity, displaceent of the colon was looked upon as unimportant, and displacements the kidneys were more particularly mentioned by anatomists than clinicians. Glenard did most to promote the clinical recognition of e changes of organ position as pathologic conditions and to associate nstitutional symptoms, such as nervousness, general debility, emia, etc., with the disorder: thus it was that the term "Glenard's

disease" was designated to the disorder, an honorary term to which this author is justly entitled.

PATHOLOGICAL RELATIONS AND CLASSIFICATION OF THE VARIOUS TYPES OF ABDOMINAL VISCERA. PROLAPSE AND ETIOLOGY.

Splanchnoptosia is the better term to employ for the condition since such indicates the ptosis (falling) of the thoracic and abdominal viscera as a whole, because the picture of more than one organ involved is the rule in by far the greater majority of cases, and also because reference is then made to the relaxation of the diaphragm and abdominal walls in the clinical make-up of the disorder. Gastroptosia and atonia gastrica signifies more particularly the abdominal ptosis (not merely the stomach), while enteroptosia pertains to the prolapse of the enteron (duodenum, jejunum and ileum). Other terms that are used to designate the special organs that are mainly involved are coloptosia (entire colon), coloptosia dextra, transversa, sinister, sigmoidea (right, transverse and left portions of the colon, and sigmoid), hepatoptosia (liver), splenoptosia (spleen), and nephroptosia (kidney). Although in most cases the term splanchnoptosia answers the best purpose, when apparently only one organ is involved or is descended markedly while the rest are in fairly normal position the term qualifying the single organ may be used.

Before entering into the discussion of the etiology and pathology of splanchnoptosia it will be advisable to call attention to the anatomy and embryology of the abdominal organs. The viscera of the body are held in their respective positions by a number of different forces, namely, the negative pressure of the thoracic cavity acting through the diaphragm and limited by the capacity confines which are made up by the structures entering into the formation of the cavities, by special ligamentous, nerve, vessel and peritoneal attachments, by the visceral pressure of other abdominal organs, the visceral shelves and most particularly by the muscular, facial and osseous make-up of the abdominal walls assisted by atmospheric pressure exerted from without. Physiologically, no organ is absolutely fixed and thus is capable of a degree of mobility to make possible the changes necessary in functionation and position, such as physiological congestion incident to secretion and accumulation (glandulature of the gastro-enteron, pancreas, liver, gall-bladder during digestion, the bulk of ingestion of foods and incidental gas formation, secretion and collection of urine by the kidneys and bladder, collection and passage of feces, the respira-

tory and circulatory movements and pregnancy); the only fixed area within the abdomen being the radix mesenterica. The mobility of the organs is further influenced by the additional factors of attitude (prone or erect), respiration, muscular movement of the viscera (rhythm), condition of the abdominal wall and gestation.

The positions of the abdominal organs may be briefly given as follows: The stomach lies in the left hypochondriac and epigastric regions, its cardiac orifice being situated behind the seventh left costal cartilage while the pyloric orifice is in the median line (organ empty) 8 to 10 centimeters (3 to 4 inches) below the xiphisternal articulation; the lowest point of the greater curvature is usually above the transverse umbilical line, and because of the overhanging left lobe of the liver the lesser curvature is not accessible to palpation or percussion. The spleen lies high and deep in the left hypochondrium, can be mapped out by percussion over the lower back and side of the thoracic region with its poles following the course of the ribs, but the organ (unless enlarged or prolapsed) is not accessible to palpation in the abdomen. The liver occupies the whole of the diaphragm on the right as well as a part of the left side, and for the most part lies under the ribs; its upper limit, according to the position of the dome of the diaphragm, varies between the third and sixth costal cartilages, although usually reaching to the fifth chondrosternal articulation in the mammillary line; its lower limits, because of being covered by the lower ribs and in the epigastric region (where exposed) and because of its shelving shape and softness, is not palpable although percussible; when the organ is enlarged or prolapsed, and particularly when firmer than normal, the lower limits of the organ may be felt, but when only prolapsed it may not be palpable and is even percussible with difficulty; the location of the lower margin, however, may be visible by a rise and fall of an irregular oblique sulcus corresponding to the anterior margin. The transverse colon passes across the upper part of the umbilical region closely following the greater curvature of the stomach; the splenic flexure reaches a higher level than the hepatic and is behind the stomach; the hepatic flexure also is not accessible to external examination (unless it is markedly prolapsed) and the liver is in place or high above it. The kidneys are situated at the back of the abdominal cavity in the epigastric and hypochondriac regions, the right kidney lower than the left and extending slightly into the umbilical and lumbar regions. The pancreas is situated from 6 to 13 centimeters (2½ to 5 inches) above the umbilicus on a level with the first and second lumbar vertebræ, and, unless organically diseased, is not palpable.

The embryology of the abdominal viscera is a source of interest for the reason that a number of authors regard splanchnoptosia as a reversion of the abdominal organs to the embryonic type. In the embryo the tractus intestinalis is a straight tube extending from the mouth to the anus, with the liver, spleen and pancreas occupying a central position. At the sixth month of fetal life the small curvature of the stomach extends perpendicularly up and down, the ascending and transverse colon extends from a straight line diagonally upward from the right inguinal region, and the right kidney is low with the liver resting upon it. With the progress of months the cecum passes from left to extreme right across the enteron (duodenum), the liver passes from the middle line to the right proximal quadrant of the abdomen, in the adult reaching to the dome of the diaphragm (at birth most of the large volume of the abdomen is due to the bulk of liver that is low in the abdomen). Thus it is seen that with the low and central positions of the organs in splanchnoptosia, its resemblance to organ situation in embryonic life is worthy of some thought in the consideration of the etiology of prolapse.

The pathogenesis of splanchnoptosia may be classed under the headings of (*a*) congenital constitutional predisposition in which is included the reversion to embryonic conditions; (*b*) acquired defects producing or encouraging the institution of splanchnoptosia; and (*c*) the combined factors (congenital and acquired) which no doubt make up the most practical aspect of the disorder as a whole in by far the largest number if not in all of the adult cases that are seen. Stiller and Obrastzow regard splanchnoptosia to a certain extent as a sign of degeneration. This, however, assumes the existence of normal persons (parents or offspring) in the first instance, and since I am a stern believer in congenital predisposition being the main single factor of cause in the majority of cases—and consequently such individuals or their parents have not been normal—I think that degeneration as a factor must be considered in about the same light as the unquestionable acquired factors. (The imperfect cartilaginous attachment of the tenth rib to the thorax (costa decima fluctuans) is merely an evidence of a debilitated nervous, muscular and flaccid ligamentous apparatus as a birth condition and not as a structural degeneration in the proper sense.)

A congenital predisposition to prolapse of the internal viscera is seen in the characteristic body form and fragility of tissue and debility of nervous energy noted in those individuals in whom these are always existent in the individual all the way from infancy to the grave. A close observation of infants and children has proven to me that the

elements of splanchnoptosia are exceedingly common in the young, and the modes of life, methods of feeding, illnesses of infancy and childhood, etc., are conditions causing the continuation of the condition or its liability as extra factors. In the light of the judgment that is given to us and the observations that we daily have in the practice of medicine, is it not more logical to suppose that splanchnoptotic conditions or tendencies date usually from the prenatal or early postnatal days of life? Robust parents give birth to the largest proportion of robust children, and the progeny of wealthy parents (who have lived along hygienic lines themselves) and whose children when they become adults give birth to children making up the second largest proportion. The parents who give birth to children during the years of the stern competition of life in quest of affluence or those who live lives improper in habits reap almost as many neurasthenics in their offsprings as those who are always more or less poverty stricken and are thus compelled to live under unfavorable hygienic conditions with their bad constitutional result. Primarily, splanchnoptosia is a status of debility or a kind of chronic neurosis represented in a chronic devitality of the sympathetic system. However pathologically this is produced, it represents to a more or less degree poor tissue soil in early life. Whether this is due solely, as Stiller has suggested, to only embryonic defect (vitium primæ formationis), or to the physical tribulations of the infant and child, or to only acquired conditions in late life, will always remain in the order of a problem and difference in each adult case that is seen.

The children that are born of poorly nourished parents, or those in whom tuberculosis, syphilis, alcoholism, or chronic disease or states of debility are present, have the largest number of offspring of the poorest quality. Added to these are the mysteriously wrought effects in children of neurasthenic and neurotic parents. Then come such conditions as improper feeding of the infant and child, the living of the child under unhygienic conditions for complete continued health, rachitis with its damaging effects on the nervous, muscular, osseous and ligamentous tissues, more or less mild and unrecognizable states of scurvy and the infectious diseases of childhood to which the child is especially prone (scarlet fever, diphtheria, measles, enteric conditions, etc.) and the after-treatment of which is not considered of much importance in medicine, but which, nevertheless, often leave a legacy the state and kind of which would cause anxious moments in the grown but which are not paid much attention to in the child. Now come the school days with their close confinement and too few moments of outdoor play and recreation, followed by the grind in college or life in

shops or factories, and then finally the wearing incidents to life in business, homes, and in women the bearing of children and dangers of post-puerperal relaxations of the abdominal parietes. Along these lines many of the adults who apparently were born healthy but who, nevertheless, had anatomical splanchnoptosia finally present symptoms which clinically are those associated with visceral prolapse.

Fig. 97.—Child of 13 years with splanchnoptosis (gastroptosis and nephroptosis). Always delicate in health. More or less chronic digestive disturbance since 3 years of age (congenital). Very neurotic. Appetite variable. Bowels constipated. More or less constant distress (she says "pains") in abdomen, at times becoming worse and running in periods of three or four months. Weight 70 pounds. Photo shows the long thorax-abdominal type in which prolapse is commonly present; also the poor development for a child of her age, and the position of the stomach (two-thirds of the right kidney also palpable). On the stomach outline is the site of the cardiac orifice, the × heart apex.

The acquired defects producing or further developing splanch-noptosia so that symptoms are developed are repeated gestations, the sudden loss of fatty tissues or extractions of accumulations of abdom-inal fluid or removal of large-sized abdominal tumors, the traction o

esions attached to the movable viscera, the influence of visceral :ion in respiration from conditions in the thoracic cavity, the evil cts of living and dressing (waist-constricting bands), as well as the ious industries. Of these, it may be said that, clinically, the mias and toxemias, the more chronic forms of infectious diseases, lty breathing and disease of the thoracic organs, with general ility from improper living, the waist constrictions, and gestations ke up the greatest bulk of factors.

A consideration of the above factors requires first a few words on anatomy and physiology of the abdominal walls. The musculo-ial structure of the abdominal parietes is attached to the fixed y parts of the costal, iliac and pubic crests as well as to the verte- column, with its vault (diaphragm) also centrally fixed by the cardium. The muscular structure consists of oblique, perpen-lar and transverse layers snugly held in a compact make-up by the ial bands and muscle sheaths so as to form a powerfully elastic, , when contracted, an inelastic wall. Its physiological action, a bined one, is that of a flat circular band for the purpose of nega-ly (without the necessity of contraction) supporting the abdominal era; Robinson has shown that, with the abdominal walls cut away the body in an erect position, the neurovascular visceral pedicles not support the organs but only limit the degree of descent. The n muscles which preserve the visceral poise are the two recti and in -marked splanchnoptosia these are often elongated from stretching, ı thinning, separation, and atrophy of the fibers, permitting, as t be evident, of elongation of the muscles as a whole and separation n the linea alba, the linea semilunares and the linea transversæ. h the muscular condition affecting also the lateral planes, the ial structure loses its tone and becomes relaxed. The inherent kness of the musculofascial walls from states of general sub-ition allowing devitalization of tissue, such as may be seen in the nic, poorly nourished, alcoholic, neurasthenic and subjects of ctious disease (tuberculosis, typhoid, and other infectious diseases enough continued), permits of first a loss to the proper visceral port and then an actual increase in the size of the abdominal cavity ne internal organs fall to the lower than physiological levels caus-a forward pressure. The skin and peritoneum, very elastic struc-s, distend, they in themselves by virtue of structural make-up being able to sustain the organs when once the musculofascial s are impaired.

Added to the loss of tone are the distending or vis a tergo pres-s that are physiologically exerted and more or less constant accord-

ing to conditions. There is then the distention and the contraction in respiration, the accumulation of ingesta, gases and feces, and the act of defecation, the process of gestation with its rapid distention of the abdominal walls terminated by severe contraction in labor and always followed by a more or less permanent physiological relaxation of the walls, and the act of laughing, coughing, etc., which also bring the abdominal muscles into play. Such pathological conditions in the chest as emphysema, pleural effusions of the pneumo-, hydro- or pyogenic forms increase the cavity size of the thorax, depress the diaphragm, and thus cause quick accommodating relaxation of the abdominal walls with descent of the abdominal organs. Ascites or large-sized abdominal tumors (conditions that usually exist long enough to more or less permanently distend the abdominal walls) on removal are followed by more or less viscera descent in about the same way as a pregnancy. Whenever there has been a rapid loss of weight for any reason, the absorption of intra-abdominal fat with the concomitant devitality or loss of tone in the walls caused by the disease also encourage descent.

The factor of waist constrictions is a most interesting one, and one which is important in a few of the instances but by no means a prominent one in the majority of cases. Diverse opinions on this exist, Finhorn believing that waist-constricting bands (corsets) play a large rôle, and Fuhs, a stern believer in the costal stigma, arguing that the frequency of splanchnoptosia among unmarried Swedish girls who have never worn corsets disproves this being so; it has also been shown that Arab women, who wear no constricting articles of clothing, are frequent sufferers from the condition. There is no doubt that, in well-dressed women who have worn the former day fashionable small waist corset, the confining dimensions and the interference with proper diaphragm descent essential to abdominal breathing cause pressure upon the liver and thus the resulting descent of the pyloric region of the stomach, the hepatic flexure of the colon and the right kidney. Still, this type of corset is not commonly worn these days, and the great majority of women have learned of the bad effects coming from that type of garment and tight lacing and thus dress accordingly. The popularly called "straight-front corset," now generally worn, which is low on the bust and coming down over the hips for purchase, is really a hygienic garment and one from which but little if any harm can come. It occurs to the writer that just because a woman wears a corset, unless this corset is of the first-mentioned type, we can hardly blame the corset for being responsible for the condition of prolapse. In my opinion, it seems wiser to assume

an indifference in this regard with the modern, properly built corset, but that with the older styles of waist-compression garment a condition of splanchnoptosia existed before the corset-wearing days, which had probably been made worse by it. The examination of many children (both male and female) who have no symptoms of digestive disturbance as well as the full grown adults will show that more or less splanchnoptosia is a common finding. The majority of these go on in life never being aware of the condition, in fact, not having digestive disorder without assignable cause any oftener than those in whom the organs are in physiological position. But when in conditions of debility and the other causes, the element of constant waist compression is added, symptoms can develop, and in this way the old style of corset may be looked upon as rather a late added but not altogether responsible causative factor.

That splanchnoptosia can develop and most certainly becomes worse from gestations there is absolutely no doubt. Landau was the first to draw pointed attention to this, since which time the pathologic eponym "Landau's splanchnoptosia" came into common usage. Landau believes that the primary cause of all cases of splanchnoptosia is a weakness of the abdominal wall, in many cases congenital, but often acquired. Riegel also firmly believed that the condition was for the most part acquired, and avers that pregnancy and parturition and the removal of tumors and ascitic fluids (which latter may be taken in the same sense as gestations) are responsible. Almost daily in clinics in which a large number of digestive disorders are handled, is obtained the history of perfect health up to the time of the birth of an infant, and a history of chronic abdominal organ and neurasthenic affections dating sharply from the parturition days. Sometimes it is after the first labor and in another case it dates from one of the subsequent pregnancies, the individual having been well up to the time of that particular gestation. Examination of some of these mothers usually shows a pitiful state of affairs in so far as the abdominal wall is concerned. There is observed a large, lax and atonic structure involving all of the component tissues, even the external integument, having a wide path of separation of the recti, with a pedunculous and bulging abdomen in the erect position and one that bulges at the flanks in the prone.

A most valuable contribution to the pathogenesis of splanchnoptosia is that of Keith[2] who believes that the condition is the result of a vitiated method of respiration. According to this author the organs within the thoracic and abdominal cavities are poised between the two contending sets of muscles of inspiration and expiration, and it

is pointed out that, although cases appear with only one organ affected all of them share in the condition to a greater or lesser extent. Before the displacement can be produced, either what he terms the thoracic supports of the diaphragm must have yielded, or the antagonistic abdominal muscles must have been hampered or weakened in their action (for example, tight corsets), the bands which fix the viscera to the abdominal walls being looked upon as of subsidiary importance.

Other factors entering into the production or accentuation of the condition are: lordosis or anterior curvature of the spine; deficient intake of food, putrefactive disease of the colon, excessive labor, and peritoneal and omental adhesions. Of the latter, Robinson[8] has called attention to peritoneal adhesions induced by trauma and also no doubt by inherent disease for other reasons in such conditions as appendicitis, cholecystitis, sigmoiditis and salpingitis, all of which form visceral masses so that the several viscera cannot glide on each other. According to this author the solid viscera masses act like a solid piston in the abdomen forcing the viscera distalward. It is more probable that the evil effects are produced more by traction upon the hollow viscera and immobility, both being due to fixed position.

FREQUENCY AND PATHOLOGY.

In discussing the frequency of splanchnoptosia it is evident that the statistics must be general in the way of organs involved. Because, as was stated before, the descent of only single organs so rarely covers the full pathology met with in the cases it must be taken that figures representing gastroptosia or nephroptosia must nevertheless be taken as those of splanchnoptosia in the more general sense.

Glenard at the Vichy resort found that 147 cases of splanchnoptosia existed in 1310 subjects—11 per cent. Einhorn saw 70 cases among 1080 males (6½ per cent.), and 277 cases among 832 females (33⅓ per cent.). In (1909) the first 150 cases of digestive disorder in the author's clinic, distinct conditions of splanchnoptosia with symptoms referable to conditions of organ prolapse were encountered in 31 (5.1 per cent.). Of these 6 were in males and 25 were in females. In addition to this, more or less descent of the various abdominal organs (stomach, kidney, liver, colon) were noted in 23 more, but the diagnosis of other conditions was so much more evident that the prolapse was not considered as the causative condition. Altogether then, in males and females, there were 54 instances of prolapse in the 150 cases of all conditions, about 33 per cent. Arneill found records of splanchnoptosia in 11 men and 69 women in 2004 cases, but these

ɜures in my experience are much too low in clinics where only the ɔor are handled, and also to a lesser extent in private practice with ıose who are better nourished and who take better care of their ealth. During the year of 1909 the cases I saw in my clinic and ffice comprising the gastro-intestinal and metabolic conditions numered 1924, and of these there were 501 instances of states of viscera rolapse with the neurotic syndrome accompaniment, a percentage of bout 26 per cent.

As regards the special organs that are mainly involved, reports of astroptosia from various sources vary markedly as to its frequency. ccording to Meinhert,[4] in Dresden, the majority of women have a isplacement of the stomach while only 5 per cent. of the men show an teration in the position of the organ. Among 2000 patients at a tuttgart polyclinic who presented themselves on account of various lments not connected with disease of the stomach, the condition was ɔted 29.7 per cent. in men and 75.4 per cent in women. The condition ı the way of diagnosis presents many differences of opinion in the ırious observers, for what would represent a definitely low stomach y one by another may be considered as the organ in quite normal ɔsition. Since the advent of the X-rays in the diagnosis of gastric fections it can be observed that the long, attenuated and apparently olapsed stomach is a most common occurrence in women, so comon in fact, that the author feels that, as compared to the shape of ıe organ in the average male, the stomach in the female is physiogically more on the gastroptosis order without its really being propsed. This is due in the female to the relatively smaller-sized waist pacity, the influence of pregnancy, the more relative commonness of ccidity and poor muscular development of the abdominal walls, and e wearing of corsets or the wearing of heavy skirts hanging on the aist bands (all of which are also considered as required factors to ıe gastroptosia). An analogy to the latter mentioned is seen in ıles who wear belts, for of 172 men with gastroptosis mentioned by irschfeld[5] 72 wore narrow belts around the waist, while among 406 en with a normal position of the stomach only 16 used the belt, the nainder employing suspenders.

Although the term gastroptosia signifies abdominal relaxation, be definite, the term will here be used as referring particularly to the w-hanging stomach, which, as was mentioned before, is usually only ɔart of the complex organ involvement in splanchnoptosia. Accordɜ to both Rose and Robinson, gastroptosia (atonic gastritis) pracally includes the terms of dilatations of the stomach, gastrectasis, stric insufficiency, motor insufficiency, ischochymia (retention of

chyme, myasthenia, etc., because it signifies abdominal relaxation and relaxation includes dilatation and motor insufficiency. My own belief is that those authors in an effort to simplify the nomenclature on these subjects have lost sight of the fact that there are other gastric conditions than prolapse which can cause myasthenia, atony, dilatation and stagnation, and that the trend of their writings is to further confuse the entire matter rather than clarify it. A gastroptosia is what its name is generally accepted to imply; the other terms are resulting conditions in some of the cases of gastroptosia but not in all, nor does "atonia gastrica" cover the other pathological conditions of the stomach in which these same conditions are also secondary.

The shape of the stomach in gastroptosia comprises a wide variety of shapes depending upon the degree of descent, the attenuation of the walls, or extent of atony which usually is more or less present. From the cardia to the point of the duodenum that is fixed to the spinal column (at the outer extremity of the first 2.5 centimeters or 1 inch of the duodenum), the organ and duodenum are surrounded by peritoneum. It will thus be seen that the pylorus itself is movable, although from the close proximity of the fixed point of the duodenum the radius here is small as compared to the body of the stomach. Therefore, the extent of sagging of this part of the digestive canal is in that portion between these two fixed points. As the lesser omentum lengthens, the stomach reaches to a lower level by swinging toward the left lateral confines of the upper abdominal cavity, the pylorus itself also dropping to a lower plane. To the extent of attenuation of the walls (the length from cardia to pylorus), the vertical diameter of the organ in the intermediate section reaches lower and lower until finally the so-called "looped," "fishhook" or "drain-trap" stomach is produced. In marked instances, the greater curvature (which normally describes an inverted arch from about the tip of the left ninth costal cartilage to above the umbilicus in the male and to about at its level or slightly below in the female) sinks to the left lateral confine of the abdomen until all but about the pyloric region is very nearly straight up and down. In such an instance, as Pfahler has shown, the stomach still remains in full volume throughout its course, and the kinking or obstruction commonly present in such a case is not at the pylorus as was formerly supposed, but occurs at the point of duodenal attachment to the spine. From Robinson's writings and observations it also seems reasonable to believe that in cases of marked enteroptosia when the coils of the enteron lie in the pelvis, the traction and depression of the mesentery could cause the superior mesenteric artery, vein and nerve (which pass in front of the transverse portions of the duo-

denum) to press upon the duodenum, cause a constriction and the development of a secondary gastroduodenal dilatation; but there is little doubt in my mind that in the average case of splanchnoptosia seen the latter is not so frequent a cause for the dilatation of the stomach as are the atonies of the organ consequent to long-standing gastric disturbance.

Of the incidence of nephroptosia, Ebstein found movable kidney in 5 of 3658 post mortems, while Landau reports only 4 cases among 6999 hospital patients. That these numbers are much too low is proven by those of Mathieu (85 in 306), Larrabee (112 in 272), Glenard (481 in 3788, 2.7 per cent. in men and 22 per cent. in women), Burnam (1 in every 5 women and 1 in every 50 men in the Johns Hopkins Hospital), and Kuttner (in 667 cases collected from the literature and his own practice there were 584 women and 83 men, a proportion of 1 male to 7 females). As regards age, displaced kidney may be met with in very young subjects, even under three years. More are encountered between the ages of three and ten years; in Kuttner's series of 326 cases, 32 were between ten and twenty years, 82 between twenty and thirty, 123 between thirty and forty, 49 between forty and fifty, 26 between fifty and sixty, and 8 between sixty and seventy. It will thus be noted that the greatest proportion is met with in those in the middle decades of life. As to race, Larrabee's series of 112 cases in 273 patients shows the condition to have been found in Americans in 37 per cent., in Irish 51 per cent., in British 49 per cent. and Russian Jews in 30 per cent. According to Kuttner's series on the relation of pregnancy to nephroptosia of 94 cases, 40 had never borne children, and 10 had borne two or more children. In Landau's series, 31 of 34 had borne no children. In Larrabee's series of 112 cases, 51 were nulliparous and 50 multiparous. The frequency with which the right, left, or both kidneys were involved was, in Kuttner's series of 727 cases, 553 the right kidney alone, 81 the left kidney alone, and in 93 both kidneys. In Einhorn's series the right alone in 77.3 per cent., the left alone in 2.1 per cent. and both kidneys in 20.6 per cent. These latter figures also correspond with those of my own.

Ventral to the right kidney are the liver, duodenum, colon, and enteron; and ventral to the left kidney are the stomach, spleen, colon, and enteron. The perirenal areolar tissue binds the adipose capsule of the kidneys to the diaphragm, and on the right side this is further attached by its fusion with the meshepaticon, and on the left side with the suspensory ligament of the spleen and coronary ligament. This, with the indirect visceral pressure, structure of the diaphragm and

chyme), myasthenia, etc., because it signifies [illegible]pports to the kidneys, relaxation includes dilatation and motor i[illegible]e in shallow fossæ. On is that those authors in an effort to sim[illegible] pedicle, composed of the subjects have lost sight of the fac[illegible] and fibrous sheath from the ditions than prolapse which can [illegible] descent. The kidneys are and stagnation, and that the tr[illegible]aphragm, and thus rise and fall fuse the entire matter rather [illegible] of them has descended to a per- its name is generally accep[illegible]mal, the close association with the conditions in some of th[illegible] and down movement with respiration "atonia gastrica" cove[illegible] is always plainly evident on examina- ach in which these s[illegible] and such movement as may exist on respira-

The shape of t[illegible] exerted upon the kidney from the other abdom- of shapes depend[illegible] also be added that the main if not the only walls, or exten[illegible] nephroptosia (Dietl's crisis) is due to a rotary the cardia to [illegible] pedicle, and not to a distal or proximal movement column (at [illegible] Slight or moderate degree of descent of these the duode[illegible] symptomless condition, and in fact, by some authors, is toneum. [illegible] as an abnormal condition at all. Robinson in some 700 althoug[illegible] claimed that in general the distal pole of the kidney extends the ra[illegible] lumbar vertebra, and noted, in the examination of 620 Ther[illegible] (men 405, women 155), that the general average was, that in th[illegible] kidney was one finger (¼ inch) proximal to the iliac crest len[illegible] left kidney was two fingers (¾ inch). This observer also th[illegible] the kidneys of women were about ½ inch more distal than it[illegible] of men, and in about 15 per cent. of the females the distal right kidney pole was on a level with the iliac crest. According to these observations the kidneys are situated lower than was ordinarily supposed and that a palpable kidney is not necessarily pathologically displaced, and, as he suggests, does not sanction surgery to anywhere near the number of instances that these cases had been subjected to.

As regards the degree of displacement Glenard describes four grades: (1) when the lower pole can be felt only during deep inspiration; (2) when the greater portion of the kidney can be felt but the upper border cannot be made out; (3) when the whole kidney can be palpated during deep inspiration; and (4) when the entire kidney can be palpated and is capable of being moved about the abdominal cavity, this latter being the true floating kidney. Ewald and Kuttner do not consider No. 1 of Glenard as that of displacement, although they substantially accept the other grades. To this it may be added that in a short-waisted person to feel one-third or even two-thirds of the right kidney also may not be pathological, particularly when it moves

directly on the excursion of the diaphragm and always at the side of the spine in vertical lines and lies deep in the abdomen.

Displacement of the liver is comparatively rare, providing we mean the descent of the complete organ, although more or less descent is common, particularly in women of the Landau type of splanchnoptosia. The reason for complete descent being so uncommon is because the liver is more firmly fixed to the diaphragm than any of the other organs and it is the highest situated organ in the abdomen. But by virtue of its weight, its wide area of extent, and on inspiration pounding upon all of the other abdominal organs, it no doubt is important in the production of general viscera descent or the aggravation of the condition. Among 31 cases of floating liver that Landau collected from the literature, 27 occurred in women and 4 in men. Glenard reports 51 cases of displaced liver, 32 being associated with movable kidney, and of these 30 were women and 2 men.

Total displacement of the spleen is still rarer, occurring probably in not more than ⅓ per cent. of cases of distinct splanchnoptosia. Glenard reports that he found "wandering spleen" in 2 of 160 cases of enteroptosia. It is probable that the instances of slight and moderate degrees of splenoptosia are more common than have been reported, but because of the inaccessibility of the organ to examination, and the fact that, for obvious reasons, even by the most careful percussion one cannot always be sure that the organ is low, they are liable to escape recognition.

Displacements of the enteron and colon are only second in importance and frequency to gastroptosia. Of these conditions the dislocation of the transverse portion of the colon producing more or less of a curve with its convexity downward is one of the most frequent factors in splanchnoptosia. At autopsy it is not infrequent to observe the middle of the transverse portion of the colon projecting into the pelvis instead of being in position about on a level with the umbilicus. On these occasions the width of the mesocolon, which in the adult is about 11 centimeters (4½ inches), may be stretched to from 15 centimeters (6 inches) to 23 centimeters (9 inches) in length. The descent of the liver and right kidney may be such as to force the hepatic flexure downward (coloptosia dextra), in which case the colon from the cecum takes an oblique course to the splenic flexure which is less rarely prolapsed. It is important to remember that the base of the right mesocolon is fixed to the ventral surface of the right kidney at its lower end, and thus with the descent of the kidney the hepatic flexure must fall. The splenic flexure rarely possesses a mesocolon, and is thus but seldom prolapsed. The sigmoid, however, has a mesentery

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noting the lowered organs.

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To separate the more definite neurological symptoms of splanchnoptosia from neurasthenia is obviously most difficult if not impossible, but in the study of a large number of distinct cases of each as they clinically present themselves, there is much suggestion that this is possible. The cardinal difference between the two is, that in splanchnoptosia the symptoms in character and largest numbers refer to the abdomen and the general neurological symptoms are mostly referred from this region of the body; the more general ones that cannot be associated with the prolapse being grouped as of lesser clinical character. In distinct neurasthenia (without splanchnoptosia) the head and special symptoms are much of a primary feature, among which may be mentioned, inability to perform the ordinary mental work, conditions of mental depression, apprehension and irritability, sense of fullness and throbbing in the head, headache usually suboccipital, weariness on exertion, pain in the back and tender spots along the spine, pain over the cervical vertebra and sacrum, sexual symptoms, the vasomotor symptoms of hot and cold flashes, localized sweatings, transient blueness, tachycardia, painful feelings in the heart, etc. In splanchnoptosia, even when a mild degree of secondary neurasthenia had developed, the subjective symptoms referring to the

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seen, as a result of unhygienic conditions making possible its production. In this way it usually dates from a definite time or period, and differs more or less distinctly from a congenital neurotic temperament, although the latter, by predisposing the individual to neurasthenia, may overlap the latter so intimately as to make distinction between the two impossible. Therefore, a person developing neurasthenia does not necessarily have or must develop splanchnoptosia, although, on the other hand, a neurotic individual, because of the nervous instability, perversion of nutrition or subnutrition, is, by virtue of the general devitality, prone to both splanchnoptosia and neurasthenia. An argument in favor of the latter may be seen in the Landau type of splanchnoptosia, in which, after the abdominal relaxation and devitality due to gestation and lactation, the viscera prolapse is more pronounced and the neurasthenic symptoms are secondarily developed from the consequent interference with the proper digestion of food; thus the necessity of the maintenance of a sufficient state of general body nutrition during gestation, parturition and lactation. It can also be said that an individual who has had long-standing viscera prolapse without consequent local or general symptoms can, from causes making possible the production of neurasthenia, develop the latter to a more or less clinical entity separate and apart from splanchnoptosia as a condition requiring primary attention.

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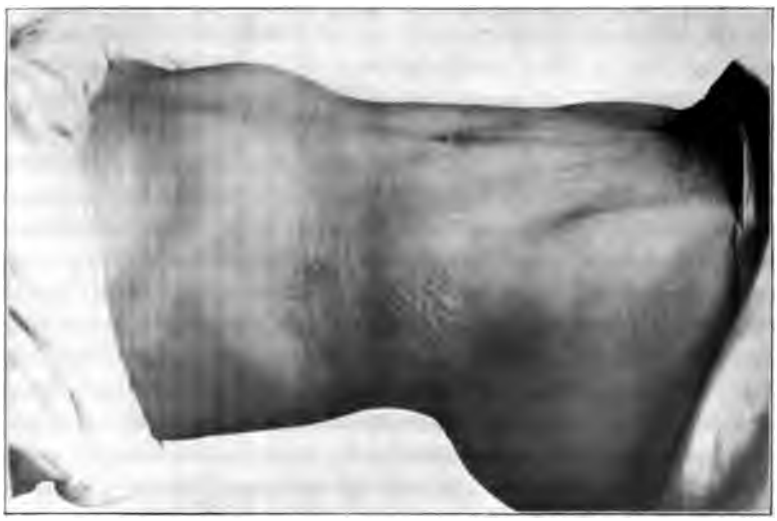
abdomen and radiating from it are: pain or distress in the epigastrium radiating to the sternum and dorsal region and shoulders, dragging or burning pains in the umbilicus, side, or spinal region below the waist line, those of gastric disturbance manifested after meals, constipation, feeling of lack of abdominal support, nausea and occasional vomiting, rumbling, gurgling and flatulency, abdominal symptoms developed or intensified when the individual has been in the erect position for some hours or by walking and same being relieved when the patient has lain down for a time, and frequent micturition from pressure upon the bladder. To these, of course, are added, to a degree

Fig. 98.—Edge of the hand sunken into the diastasis of the recti muscles below the umbilicus in a case of Landau splanchnoptosia.

depending upon the extent of general secondary neurasthenia, those enumerated in the first instance.

Objective Symptoms.—The objective symptoms of splanchnoptosia are usually those of a thin, pale, young woman or man, slight in build, of the long thorax and abdomen type, with a thin, soft and atonic abdominal wall, and possibly a floating tenth rib. The Landau type is usually better nourished than the nulliparous women, the first being plump in build and may even be quite stout. The only distinctive objective feature of these cases, however, is the shape, and the change of shape of the abdomen in the erect and horizontal positions.

PLATE LIV.



Abdomen in a clinic case of splanchnoptosis. Upper figure shows the profile f the abdomen with its convexity above and its protuberance below in the lower ones of the abdomen. The sag of the abdomen produced the side relaxation shown y the bulging over Poupart's ligament. The lower figure is of the same patient n the dorsal position, and shows the characteristic flattening of the abdomen, ue to the recession of the ptosed internal organs, and the bulging in the flanks.

[redacted]

ing the lower trunk in profile in the latter-mentioned cases it bserved that the outline is that of a pendulous abdomen, a straight or a concave outline from the ensiform to about rse level running from the lowest ribs. From there down- ins a sharp convexity forward rounding out a very low and lomen that overhangs the mons veneris. With this there is ıteral bulging, which, from the depression of the midline ves to the abdominal prominences an inverted insect-winged ɔn viewed from the front. A relaxed roll of abdominal tissue from a little in front of the anterior superior spines of the ward level with the crests, to be lost about two-thirds of the from the front and back outlines. In the prone position the

g. 99.—Clinic case of Landau. Mrs. A. M., 28 years old. Family negative. Personal history good, in so far as digestive organs are ed. Bowels had always moved daily before labor. Primipara, d by midwife December 12, 1906. Labor normal. Child weighed ls. Bandaged indifferently for one week, not afterward. At her c duties on the tenth day. Symptoms of illness came on two after delivery. Photo shows the concavity of the abdomen above bilicus and the bulging of the lower zones. There was but little ile and sustaining power in the walls above the navel. Below the ıe contraction was more pronounced. She had very poor control : musculature of the abdomen. When examined three months after she had marked gastric stagnation with accompanying symptoms. strongly constipated. Had constant pain in the back and right iliac was unable to work, and had to rest on her back most of the time elief. She was practically an invalid.

order is inverted, that is, the anterior abdominal line becomes flat, the umbilicus has raised to a relatively higher position, the anterior edge of the ilia at and below the anterior superior ilia spines becomes prominent, and the greatest degree of bulging is at the sides and flanks, caused by the replaced viscera being in higher planes within the cavity.

On examination of these abdomens it will be noted that the general tone of the structures is impaired, the abdomen being flaccid and capable of being readily pushed about. A more or less degree of separation of the recti (noted best below the umbilicus) will be

Fig. 100.—Same case, showing the degree of descent of the stomach, colon, liver, and right kidney.

observed, and by the contraction of the abdominal muscles by the patient (straining as if at stool) it will be noted that the wall has lost its firm and board-like contracting power, seen so generally in the normal. The objective points in the examination of the special organs will be taken up separately.

Gastroptosia.—As was stated before, the special objective signs that constitute a prolapsed stomach are to some extent still a matter of personal equation with each observer. In arguing this it must be remembered that the position of the stomach in the erect position is

always lower than that in the prone, and thus it is that percussion of the organ in the prone position may show a normal shape and size of stomach and a gastroptosia really exists. Percussion in the standing position is most unreliable for the reason that whatever fluids the stomach contains sink to the lowest regions (and thus obscures the note), and the gases rise to the inaccessible fundus and lesser curvature regions. It may, however, be said that an inflated stomach which on percussion corresponds to prolapse of the organ in the prone position is always prolapsed, and that when the area that the stomach cavity occupies does not respond in mobility in the changes from the erect, horizontal, and then the head low and feet high position, or on respiration, it is most probably held in the fixed position by perigastric adhesions.

The normal stomach at its upper two-thirds is almost vertical, and the lower one-third is nearly horizontal, the lowest point of the greater curvature being about 2.5 centimeters (1 inch) above the umbilicus in the male, and near to or at the umbilicus in the female. When in the prone position the greater curvature is below these points the organ is either prolapsed, dilated, or both, although if the examination is made in the erect position a slightly lower standard of departure from the normal must be taken. Percussion of the stomach is a simple and accurate method of diagnosis, and in my opinion nowhere near so misleading a method as is often supposed. After inflation of the empty stomach the limits of the organ can accurately be made out by percussion throughout all excepting the very end of the pyloric region, and under the conditions of artificial distention the colonic resonance (the transverse colon overlaps the lowest extremity of the stomach) can easily be eliminated by the acoustic difference between the two. However, it is always best when in doubt, and when depending upon all methods of examination other than the X-rays, to examine the stomach after a purge or enema to unload the colon. When confused, one can get a fair idea of the degree of gaseous distention of the colon by percussion over the ascending or descending portions, noting the character of the percussion note, and after this locating the lower border of the stomach. In so far as percussion is concerned, the point of difference between gastroptosia and dilatation which Kemp[6] has drawn attention to is most important, namely, that in dilatation the lesser curvature retains its relation to the diaphragm and the distance between the lesser and greater curvature is increased, whereas in gastroptosia, the entire organ descends drawing away from the diaphragm, the vertical dimensions of the organ being retained; this rule holds good when only one of the two mentioned conditions exists. Care

in examination must be taken in this regard that one does not confuse the dullness of the overhanging left lobe of the liver for the absence of tympanitic note of the stomach; this, as a rule, can usually be obviated (providing the liver is not also ptosed) by a rather deeper vertical percussion stroke as we approach the lesser curvature. The methods of inflating the organ and further points in percussion are described in Chapter V. Of much value in percussion is, at points slightly to the left of the midline of the abdomen, to note the positions of the lower and upper curvatures under the three conditions of respiration—rest, deep inspiration and deep expiration. In marked states of gastroptosia a mobility of the pyloric region of 15 centimeters may be noted under the two extremes of respiration, the greater curvature descending well below the umbilicus.

Another of the objective signs is a loud splashing in the umbilical region noted on a series of downward strokes delivered with the tips of the fingers, or preferably with the ulnar surface of the little finger with all fingers extended and in apposition. This sign, which in value is still in debatable grounds, is so commonly present in these stomachs that it is a most valuable diagnostic measure. It is due to agitation of the fluid stomach contents in the presence of gas, and when found one or two hours after ingestion of fluids a prolapsed stomach with atonic dilatation is generally present although only the latter may be present. While I am willing to admit that this symptom may be noted in thin and apparently healthy persons, still, when marked, it always represents myasthenia or atony, or prolapse, or both. A healthy stomach is usually capable of contracting strongly enough upon its contents so as not to permit of it. Care must be taken that the splash produced is not in the colon, but in these instances a diarrhea usually exists, and by placing the ear over the upper regions of the stomach and shaking the patient the succussion sounds produced in the stomach are usually confirmed because, as described in Chapter V, the best plan in flicking is to approach the stomach from below the organ.

Another valuable suggestion in the diagnosis is epigastric pulsation from the abdominal aorta which was emphasized by Glenard. The noting of this usually means that the stomach has descended and there is none of the organ between the hand and the vessel. This sign is of the most importance when noted at the time that the stomach contains food, for the simple reason that the pulsation of the vessel may sometimes be felt or seen through the walls of a collapsed stomach.

The gastrodiaphane may also be used to note the location of the lower curvature, but is not of much value to map out the other areas.

Its use is unpleasant, requires the drinking of large amounts of water for the examination (which is harmful), and also a special apparatus, a battery, and the loss of much time in the examination.

But of all signs and methods, the surest and most definite is observation by the X-ray-bismuth method of examination. By the employment of this means the location, size and shape of the entire organ from the fundus to the pylorus is accurately noted, and, best of all, the examination can be made in the erect position—that in which two-thirds of each day is spent and the hours of organ position during digestion. By another observation in the prone position, the mobility of the organ can easily be noted, which is not only an important practical feature in the diagnosis of prolapse (as well as many other gastric affections) but also in the therapy for that condition. (See Chapter V.)

It is a most common clinical finding that when a kidney is felt (nephroptosia) gastroptosia is also present. The noting of the gastric secretion is not of much value in the diagnostic way. Some authors (Steele, Francine, Brown) claim that subacidity is the rule. In my own practice I have not found this to be so, the cases being about evenly divided between the three conditions (of 172 cases of distinct gastroptosis I found normal secretion in 51, hyperchlorhydria in 47, subacidity in 68, and anachlorhydria in 6). More commonly, however, is a sensory neurosis in varying degrees, in some of the cases bordering upon a distinct gastralgia. Unless dilatation or stenosis is a feature, the motility in these stomachs is good, this being in by far the largest number normal or just a trifle short of normal. A degree of chronic gastritis is not an uncommon accompaniment, having been met with in 11 per cent. of the above-mentioned cases.

Nephroptosia.—The diagnosis of movable kidney is quite easy, but more difficulty is usually encountered in deducting as to whether the symptoms present are due simply to detachment of these organs, or to the more complex make-up of splanchnoptosia that is generally present. Quite naturally, these organs, because of their small size, deep situation even when low, or mobility when freely movable (floating), cannot be diagnosticated on inspection or percussion. The same may be said with regards to the X-ray method of locating their position by the ordinary methods of radiographic technique now general, although recent work along these lines by the employment of a deeply depressed diaphragm has made it possible for me to obtain some excellent plates showing a kidney shadow away from the fossæ.

The main means of diagnosis is by palpation of the kidneys through a relaxed abdomen (knees raised and slightly separated and

abdomen relaxed). If the kidney is freely movable we may feel the organ upon very superficial palpation, noting it as a hard mass, slipping away from under the fingers when sharply pressed upon, but capable of being grasped between the fingers of both hands when the diaphragm is quiet. A body like this that can be pressed beyond feeling under the liver on the right side, or under the stomach and costal margin on the left, or can be pushed from one side of the abdomen to the other is usually a kidney having a long pedicle. If the kidney is not so movable, it would be felt at the side of the vertebral column deep in the posterior abdomen. On these occasions, particularly when the subject is rather stout, bimanual examination becomes desirable, and it may further be necessary to examine the patient after a prolonged hot bath or after the application of a moist, hot poultice about the abdomen.

In my experience, bimanual palpation is best performed in the two-posture method, that is, erect position of the trunk so that the organs are at the lowest level, and then the horizontal to encourage them slipping to a higher plane. This is performed as follows: In examination of the right kidney the physician stands at the right of the patient (sitting) and with the left hand grasps the lumbar region. The anterior thumb must be directly under the lowest ribs while the other four fingers lie flat and well over the back, the arch made by the thumb and index finger being sunk as deeply as possible into the side. The patient is now requested to breathe deeply and slowly, and at a favorable moment at the end of deep inspiration a firm grip is obtained, after which the patient, while holding the deep breath, is made to lie down. The right hand is now employed to make pressure upon the abdominal viscera below, in first a downward and then a horizontal direction under the upper thumb. The noting of a loose kidney slipping upward under the left thumb is very distinctive and characteristic. In examining the left kidney the physician stands at the opposite side of the patient, and the hands are reversed. Under normal conditions the right kidney is just about palpable on deep inspiration in thin subjects, the left not at all. In the stout, the right kidney is not palpable unless prolapsed.

Symptoms on the part of the kidneys are rare in comparison to the number of cases of movable kidneys that are met with. In some instances there is described a dragging sensation or pain in the back a little above the waist line. In others there is obtained a history of attacks of nausea, coming and going suddenly, which, even in the symptom-complex of splanchnoptosia, may be quite suggestive. When the kidney has become movable to such an extent as to permit

PLATE LV.

FIG. 1.

FIG. 2.

Method of Bimanual Palpation of the Kidneys.

Fig. 1.—Patient sitting. The thumb and index finger arch of the hand sunken o the side close to the small ribs, the thumb making deep pressure at the end of piration, the other fingers on the back.

Fig. 2.—Patient lying. The other hand making deep and upward pressure on under viscera, delivering these under the upper thumb.

›n of the pedicle so as to produce kinking of the ureter or essels or torsion of the renal nerves, the so-called "Dietl's ıay be present. This is observed as a sudden attack of nausea, g, and severe pain in the renal, along the course of the ureter, the bladder regions. During the seizures, the pulse is small ıuent, the skin cool, a cold sweat bathes the body, and the is most anxious at the acute distress. Following the attack, and blood may be found in the urine, and in pronounced cases phrosis, pyonephrosis and pyelitis may also be present. An late may show such a kidney lying in contact with the anterior ıal wall, providing it be taken with the patient lying with the ı upon the plate. The following one shows this plainly:—

Fig. 101.—X-ray showing a markedly prolapsed left kidney in contact the anterior abdominal wall, situated to the left of vertebral column ıbove umbilicus, and a gastroptosis of marked degree with dilatation e pyloric region. Attacks of Dietl's crises were prominent in this and which subsided after the kidney was anchored. Markers at the ›rm and umbilicus.

›atoptosia.—The symptoms of wandering liver are manifest, ›rgan is so large that when displaced this is readily recognized ıtion and percussion. It is a good practical rule to follow that vhich is palpable below the costal arch in the mammillary line enlarged or prolapsed, and the plainer the edge is felt the surer t it is enlarged from inherent disease. Noting the lower edge ning the characteristic dullness on percussion in the abdomen, :n essential to observe the vertical dimensions of the liver by

percussion. At respiratory rest, the upper limit of the right lobe runs about on a horizontal line from the junction of the fifth right costal cartilage with the sternum horizontally outward to a little below the nipple, and then it is inclined downward to reach the seventh rib at the side of the chest. The upper limit of the left lobe (which on account of its relative thinness to the right lobe, and the overlying sternum and costal cartilages) is not so definitely percussible but runs on a line from the starting of the above to about a point on a level with the sixth left costal cartilage, the extremity of the lobe being at about 5 centimeters (2 inches) to the left of the sternum. It must be remembered that on deep inspiration the upper limit of the organ is lower than the above, and on complete expiration it is higher. There are no symptoms in particular referable to this organ in conditions of prolapse, and those present in a case are those of splanchnoptosia in general. In my experience, these cases of prolapse are always severe in their clinical make-up, and are difficult to obtain results on.

Splenoptosia.—Displacements of the spleen are very rare. Such instances may be observed in accumulations in the left chest, whereas, a palpable organ due to valvular lesions, hepatic cirrhosis, typhoid, malaria, leukemia, etc. usually means its enlargement and not prolapse. Even more sternly so than with the liver, a palpable spleen is always enlarged or prolapsed. These are best noted by examining the patient in the prone position, the organ appearing from under the depth of the costal arch, the hard, round, sharp-edged mass being projected on deep inspiration. When feeling such a mass some confusion may arise as to whether it is the spleen or the left kidney that is felt. In differentiating these it is important to remember that the spleen is much less frequently prolapsed than the left kidney, that the spleen usually projects from the depth of the costal arch and in an oblique line forward toward the umbilicus, and that the kidney is always more deeply situated and projects along the vertical line of the vertebral column. The absence of the splenic dullness from its normal area, and the noting of one or more incisures along the anterior border of the mass are also helpful in diagnosing prolapse of the spleen.

Coloptosia and Enteroptosia.—These are most commonly met with in Landau splanchnoptosia, for in men and nulliparous women marked states of prolapse of the intestine are only found about third in frequency to the stomach and right kidney. The condition can be assumed when the abdominal wall is lax and pendulous. Among the more definite subjective symptoms are: constipation possibly alternating with a diarrhea, fermentations and borborygmus, dragging sensa-

tions in the back, and, from the colonic catarrh, the passage of mucus (both fluid and in shreds) with or without stool.

In so far as the objective symptoms are concerned, the only method of examination that has served to definite purpose in my hands is the use of the X-rays. To these ends the bismuth mixture is taken by mouth and the exposure made twenty-four or thirty-six hours afterward when the bismuth would be continued in the colon. A routine that serves to the best clinical purpose in cases of splanchnoptosia is to give the bismuth-food mixture and make a fluoroscopic observation or plate of the stomach, after which the patient returns on the next day and an X-ray picture is taken of the colon. Observation in the interval between these times for the purpose of noting the small intestine are usually valueless for the reason that the bismuth distributes itself throughout the coils of the small intestine and only a large black shadow area with no detail is produced. For the colon observations by X-ray, the fluoroscopic screen does not answer to the value that the making of a plate does. Another method when only the colon is to be observed is to give the bismuth mixture per rectum taking advantage of posture to distribute it high in the gut (knee-chest position). Another method is to employ air for the purpose of demarcation, using a colon tube and a hand bulb to distend the colon (gives dark areas on the negative instead of the light ones of bismuth). For detail of the technic see Chapter V.

In the absence of an X-ray examination, the location of the colon may be fairly well made out by distention with air per rectum and physical examination. The hand bulb attachment for distending the stomach (page 113), excepting with a rectal or colon tube attached, may be employed for the purpose. Preparatory to the observation it is essential to clean out the colon contents by a purge given the night before (castor-oil best), or an enema just before the examination is made. The tympany of the stomach (which is confusing in mapping out the colon after distention) is best obviated by the examination being performed shortly after the taking of a meal. The colon tube is introduced as high as possible, and when *in situ* the patient lies on the back. Air is then pumped into the gut in amounts necessary to obtain a well-defined tympanitic note on percussion over the descending colon. As one rarely can achieve more distribution of the air than in the descending and transverse colon, we must be satisfied with this. I have observed on a number of occasions that, if some time is allowed between the introduction of the air and the examination (ten or fifteen minutes), better results in the way of mapping out the transverse colon are obtained.

Cardioptosia.—The possibility of this condition is suggested after the diagnosis of splanchnoptosia had been made. In a normal individual in the left lateral position the displacement of the heart is on an average 2 to 3 centimeters to the left, and in the right lateral position about 1 centimeter to the right. As is well known, the normal site of the apex beat is in the fifth intercostal space about one-third of the way from the mammillary to the midsternal line. In the absence of organic disease of the heart or the lungs, a displacement of the heart is easily noted by palpation and percussion.

PROGNOSIS OF SPLANCHNOPTOSIA.

Many more cases of splanchnoptosia exist without symptoms than with them, therefore, in the first no treatment is necessary and it is best not to strongly emphasize to the individual the existence of the condition. It is always well, however, to give such persons advice in a general way so as to guard against the development of symptoms at a subsequent time. Among such may be mentioned the use of tonics, hygienic measures, corsets and belts, special attention after parturition, etc. With such individuals who can add to their existence matters of a prophylactic nature the chances of the development of symptoms are small. For these reasons it is well to observe the child and advise mothers on these points in susceptible children. Unfortunately, the first time that practically all of the cases are seen is in those of adult years and in whom the symptom-complex is well established. In these, as a result of careful and persistent treatment, a success is met with in the way of relieving the symptoms in the great majority of instances. In the very rare cases of only one organ affected, or a single organ being sole producer of the symptoms (kidney), surgery has afforded some signal results in the way of relief and even cure of that special organ. It must be obvious that when a complicity of organs has been low for years, complete cure cannot be expected to be brought about by medical or even surgical means. To substantially relieve the patient of the symptoms produced by the loss of compensation, the interference with functionation, the general neurological symptoms, etc. is the limit of hope we have any right to entertain. But in these there is a small proportion of cases in which, even with most persistent medical and in the face of the most serious surgical treatments, the results always remain discouraging. These unfortunate individuals are to be viewed truly as subjects of a chronic illness as are most of the cases of organic spinal affections. We can relieve them from time to time, and with great care they live out

their allotted years of life. Splanchnoptosia is not a fatal condition, the severe and long persistent cases arrive to the grave by way of resulting or intercurrent affections.

TREATMENT.

Prophylactic.—To prevent the development of symptoms in splanchnoptosia, it is important that the tendency to its production should be observed early and the prophylactic measures carried out. Children (and young adults) with the characteristic body form should be recognized and made to live accordingly. Insistence should be placed upon the necessity for abundance of fresh air and outdoor exercise. Their foods should abundantly comprise such articles of diet as have the greatest nutritive values in the smallest bulks. The dietetic caprices of the child should be met with a stern insistence upon the taking of such foods as would maintain the highest status of nutrition. Among these may be mentioned the employment of eggs, meats, poultry, fish, butter, cream and milk; the high albuminous vegetables, such as peas, lentils, beans and grains; and the heat and energy makers, starches and sugars and the hydrocarbons. A rest of an hour after eating is often advantageous, and the keeping of late hours after the day's work should be controlled. Effort should be made when the children are old enough and with the adults to develop the strength of the diaphragm, the intercostals, and the abdominal walls by deep breathing exercises in the hope of enlarging the lower thoracic zone, as well as other chosen exercises to develop special groups of muscles (abdominal). When the girls are old enough to wear corsets attention should be paid that the waist-compressing styles are not selected, and that tight lacing is not permitted. In the adults the ordinary straight-front corset should be worn in preference to none at all, and this should be tightly laced below the transverse navel line and kept as loose as possible above it. In youths and men the wearing of a belt may be permitted, but the rise of the trousers should be short enough so that the belt just fits above the iliac crests and not at the waist line (this manner of wearing a belt, to my belief, is even to be preferred to suspenders in all instances).

Attention should be paid to all persons, whether children or adults, after an acute or chronic illness associated with loss of weight and body tone that they receive a prolonged medical attention, and not get out of bed or return to work too soon. The employment of systematic overfeeding, tonics, regular hygiene, and possibly a sojourn in the country should be advised. These rules apply in cases

of measles, scarlet fever, pneumonia, diphtheria (particularly in the presence of complications) to almost the same extent as they do to typhoid fever and other prolonged fevers. Care is necessary after the reduction of weight in obesity cures, because, if the loss of weight be too rapid or too pronounced, a general loss of tissue tone results. The same holds true after operations for the removal of large-sized abdominal tumors or the removal of ascitic fluid; because of the shortage of intra-abdominal pressure before sufficient retraction of the abdominal wall has taken place to sustain the organs. Since the aftermaths of pregnancy make up a large bulk of these cases, a few extra words on this would not be amiss. Quoting from an article of mine, Bassler,[7] I again present the following: "The gravid uterus at term occupies practically all of the possible space in the abdominal cavity, particularly in the prone position. It reaches superiorly close to the under surface of the liver, and in breadth almost to the limits of the lateral confines of the abdomen. In the upright position the intestines are posterior to the uterus; in the dorsal position they lie chiefly to the sides, but partly too in front of the uterus. In the upright position the uterus in advanced pregnancy rests upon the anterior abdominal walls, the component tissues of which are immensely stretched and somewhat thinned. The fasciculi of the recti and side muscles increase in length, slightly in thickness, but not in numbers. The joining borders of the recti, especially below the umbilicus, separate, causing a weak space in the forewall of the abdomen, which persists more or less after the delivery.

"In even the most favored cases a certain degree of relaxation of the abdominal parietes, with some accompanying degree of ptosis, persists after a pregnancy. In a strong, well-nourished woman this goes on without the development of any subjective symptoms and may be considered physiological. But under less favorable conditions there is always a danger of the loss of sufficient sustaining power of the walls persistently encouraging still more descent of the organs within. The recti are the big factors in this, the lower segments of which muscles are usually found bulged forward and the upper segments loose and flaccid. Thus here we often see the mechanical elements of cause found in these cases.

"Another basic cause in Landau cases, as well as in all cases of ptosis, is subnutrition. The pressure of the gravid uterus on the digestive organs gives rise to many functional disturbances. There is diminished intestinal activity affecting the digestion of foods, and being more commonly the cause of constipation than obstructive pressure of the uterus. The blood changes incident to pregnancy may

also affect the nutrition unfavorably. In the early months there is a hydremic condition of the blood, and it is always questionable if the enriching of the blood in advanced pregnancy in hemoglobin and total number of red blood-cells is equal to the greater demands that are made upon it. There is generally more or less vomiting and gastric disturbance, due to spasmodic contraction of the stomach and diaphragm. The vomiting may be severe and persistent enough to keep the woman undernourished for some time. The vital capacity of the lungs is diminished, interfering with the proper oxygenation of the blood. The taste and smell are often affected, so that there may be repugnance for food of the best kind and there is often found insatiable demands for food of a low nutritive value. To all these there may be added a length of intoxication of the body due to the pregnancy and more or less impairment of the renal function. And lastly, to the mechanical and nutritional changes, are added the nervous ones, making complete the great triumvirate so often seen in cases of splanchnoptosis. The nervous system during pregnancy becomes impressionable, so much so that in some women already so predisposed it may terminate in insanity, and how simple it is to understand that the great factor of neurosis in digestive disturbances could easily make its beginning here!

"It is interesting to observe that in the histories of 86 consecutive clinic cases of women who had been pregnant who came under my observation for treatment of some continued digestive disorder, in 21 a resulting state from pregnancy was believed to be the weight that threw over their former balance of health. Of these 21 cases, 15 were primiparas and 6 were multiparas. Of the 15 primiparas, the average age of which at the time of their delivery was twenty-two years, the average length of time for the development of subjective symptoms was 5½ months after parturition. Taking the single-child cases, for they are the best in point, they were all cases of plainly evident splanchnoptosia of one or more of the abdominal organs, combined with various disorders of motor, secretory and sensory origin.

"An abdominal cavity which has been subjected to a rising internal pressure for months, when suddenly collapsed, from whatever the cause, suffers a shock. What other explanation can be given to the chill immediately following delivery? Then come the long days of slow return of the walls and their contents to the normal condition. In this light where is contained the wisdom in the growing custom of late years of advising against the use of the old-fashioned binder which does so well in equalizing the lowered intra-abdominal pressure by its support to the walls? The only reason I have been able to obtain for

this change in practice is that a tight-fitting bandage is liable to malpose the uterus and thereby possibly favor the establishment of some permanent malposition of this organ, or that the binder was very liable to be soiled and therefore uncleanly and unsurgical. The first is about as absurd as the second is indicative of neglect. It is true that at the post-partum visits the binder is usually found loose and above the iliac crests, but is this not due to carelessness on our part in failing to instruct the nurse how to properly apply the bandage? That it is an uncomfortable appliance to the woman is not borne out by her statements, who, if anything, gladly welcomes the support that it gives even to the very end of resolution, which in a normal case usually takes about six weeks' time. And the last prop is knocked from under the argument when it is contended that it is too warm and distressing a thing for a patient to keep on in summer, when the thinnest skirt she ordinarily wears is not less warm.

"As soon after delivery as possible, in all cases, a bandage should be put on. It should be wide enough so as to extend from the middle third of the thigh to the ensiform process. It should be shaped to the abdomen by being tucked at the sides from above downward, and be boned in the back, at the sides, and in front so that it stays in place. At intervals during the post partum the abdominal wall should be examined to note its muscular power, its tone, and general condition. This is best done while the patient makes effort at straining as if at stool. Attention should be paid that the bowels move freely and that gases are not permitted to accumulate in quantity. The bandaging should be kept up for at least two months after delivery, and for four or six months in cases in which the abdomen is inclined to remain loose and pendulous. Should the danger of splanchnoptosia be great, after she is about, an elastic belt or a proper-fitting corset should be used instead of the muslin bandage, which is not so comfortable for locomotion. One such as the kind I ordinarily use in Glenard's disease is good. This belt possesses an advantage over others in that in addition to its support it raises the lower abdomen upward as well as backward by the use of what may be called an artificial mesentery, an elastic strap which tends to approximate the lowest point of the belt in front to the highest point of the belt in the rear. This strap is adjustable to different degrees of tension. The belt itself is especially constructed to take this low and high position. There are some who contend that an abdomen so supported for a length of time by the belt or corset loses its tone and afterward the patient becomes dependent upon such support. But as the bandage or belt does not interfere with the action of the abdominal muscles, and as a support

from without neutralizes the further baneful vis a tergo of the sagging viscera within, this contention is not well taken. If any effect is seen by the use of either of them it is one of added tone and benefit. I am not averse to a bandage or belt being worn for six months after delivery in all women.

"In imminent cases, at such times as it is deemed advisable efforts should be made to strengthen the muscles by exercises, the most valuable of which is for the patient to make, often during the day, voluntary contractions of the abdomen as a whole. While difficult at first with most women, the art of doing this is soon acquired. The patient's attention should be directed to the lower abdominal zone, and she should try to flatten, by a slow, strong and deliberate effort, all of the abdomen below the navel. They all soon get control of the lower segments of the recti, etc. This exercise can easily be carried on in bed, and should be kept up for several weeks at least. The only other exercise possible while in bed is the raising of the body to a sitting position. To do this properly the lower extremities should be held down. When she is about, this is best done by the woman putting her feet under some piece of furniture and raising herself from the floor with her arms extended over her head. The third best exercise is the raising of the lower extremities, back on the floor, in stout women to the vertical position, in slim women the toes may be made to touch the floor over the shoulders. The fourth and fifth movements are carried on while standing with heels together. They consist of a rocking motion down from side to side, and a twisting motion of the trunk, first one shoulder forward, then the other. In loose clothing these movements should be carried out mornings before the belt is put on, and evenings after it is taken off for the night. In imminent cases they are very valuable measures and should be insisted upon strongly. Abdominal massage, electricity, and hydropathic measures I merely mention as not deserving of much attention in the routine of these cases.

"In all cases of women who have been delivered, and for many weeks afterward, the diet should be of the highest nutritive value and pushed to the very limit of digestive capacity. The meals should be small in bulk and frequent. Food every three hours is not any too often in an imminent case. When the patient is about and taking three meals a day, supplemental meals of milk, eggs, bread, butter, and so on should be advised. When the danger of ptosis is great the giving of much fluid should be guarded against. The choice of food should be liberal and it is often wise to disregard any mild dyspeptic disturbance and feed the woman generally as well as generously or

she runs the danger of being underfed. It is best to lay out a plan of diet with the quantities, and insist upon her meeting it. The main purpose of the diet is to add rapidly to her weight. The carbohydrates are strong factors in this. This forced feeding is also of value to nursing women and in the anemic and poorly developed.

"It is often beneficial to make the mistake of keeping the woman in bed too long. She should be encouraged to rest after her heavy meals for some time, and warned against any fatiguing or violent efforts for two months. In cases in which the abdomen remains pendulous and the walls weak, it is wise to advise a morning and afternoon rest of two hours with the buttocks raised so as to have the

Fig. 102.—Case showing the development of the abdominal muscles from exercise. E. L., aged 26 years. Primipara. Delivered August 1, 1906. Normal labor of eleven hours; slight perineal laceration; child weighed 7½ pounds. Kept up her exercises for five months after delivery; gained 10½ pounds. Photo taken 7½ months after confinement.

viscera gain a higher level in the abdomen. Another good plan is to have her sleep for some weeks in a bed raised at the foot end.

"At the time of making these observations and through the kindness of several friends, I interested myself in thirteen first-baby cases attended by four different practitioners of medicine of this city. While the number was too few to gain more than a general idea of the benefits possible to accrue from attention and treatment along the

f preventing splanchnoptosia, still, there were some very striking from the exercises, high feeding, careful bandaging, etc. In case fifteen months after delivery, none of the women had any ant digestive disturbance, and in all the abdominal walls were l condition. Their gains in weight ranged from 7 to 31 pounds han their weight was before the beginning of pregnancy, and iled to show a gain between these figures.

)f the seven who may be classed as neurotic women, in six the s condition had been much benefited. Three of them I had to believe were tubercular subjects, and in one there was a ques- f syphilis, although the infant showed no lesions up to the th month. Even these four were in better health than they had

Fig. 103.—Case that showed the highest gain in weight. A. W., 27 's old. Primipara. Delivered November 17, 1906. Child weighed 10¼ ids. In active labor twenty-one hours. Troubled with nervous indiges- before her pregnancy, not since. Weighed March 2, 1906, 129 pounds; e months after delivery weighed 160 pounds. Perfect result. Nursed child and claims she never before felt so well.

efore. Seven of the women were slim, and four of these were tly of the long, narrow thorax and abdomen type in which con- of prolapse are so common; still, none of them developed any ve troubles whatsoever. All but one nursed her infant, and the e shape of the abdomen as well as the condition of the wall ed most favorably with the single-baby cases followed by noptosia that I saw at the clinic. I don't doubt that with suc-

cessive pregnancies their abdomens, even with the same degree of care that was given them during the first parturition, may not be so good. Nevertheless, I feel that the efforts of these women were not in vain and the treatment was not trying or irksome, and also that more general observances of post-partum treatments like were carried out would give material and lasting benefit to those mothers in whom sacrifice of health is the price they pay for giving birth to children."

General Treatment.—These comprise those measures which will build up nutrition and vitality. The diet for splanchnoptosia should

Fig. 104.—Case that showed the poorest abdomen and the least gain in weight. Primipara, 27 years old. Delivered January 3, 1907. Infant weighed 7¼ pounds. In labor three hours. Photo taken three months after delivery, showing the long, narrow abdomen with still good configuration. Woman perfectly well. Discarded the bandage, but still exercising.

be abundant in foods having the highest nutritive value for the bulk, and a special dietary, also outlining the plan of meals, should be given to each case. One should be careful not to permit these patients to partake of too large meals or much fluids of any kind. Moderate-sized meals, the three of each day being about the same in size and character, are better than a small breakfast and luncheon followed by a large dinner taken at the time of the day when the physical and nervous energy is at the lowest ebb of the three. In the effort to add nutrition and still keep down the bulk, the proteid foods answer to best purpose, but to these should be added the hydrocarbons and car-

bohydrates so as to preserve the tissue metabolism and to prevent monotony. Glenard advised a diet depending mostly on meats, and gradually adding stale bread and green vegetables, but avoiding acids, wines, cereals and fats. In my opinion, the diet should be mixed from the start (regulated possibly to a degree but not to too great an extent according to the gastric analysis or in the effort to overcome constipation). When anorexia exists and only small amounts of food can be taken at a meal, raw eggs, or half milk and cream, a sandwich, cocoa made with milk, etc. should be taken in the meal interval and before retiring. By the more frequent meals (and a four meal a day plan of feeding answers well when supplemental meals are not practical), the danger of gastric dilatation is eliminated to a degree, and that present is benefited. Also, the steady method of feeding adds weight more rapidly, and, as this increases, the symptoms usually subside. The dietary need not be built up on quantities according to calories for the day, but the caloric principle should be considered in the selection of foods so that the best values make up the largest proportion. A few rules that will be found helpful in practice is to employ the three meal a day plan when the appetite is good, the three meal a day and supplemental meal plan in cases of anorexia or in those who are employed in business, and the four meal a day plan with those who have marked anorexia or who live domestic lives. Although Glenard has advised against the use of fats, in my practice they have been most helpful, excepting in a few cases of fat intolerance. A dietary list something like the following, which can be made up on a three or four meal a day plan, is recommended:—

The plan of the diet is to eat.....meals a day; to eat moderate quantities of food, taking about the same amount at each meal, and not to partake of anything in the fluid line, not even such fluids as soups, coffee, tea, cocoa, water, milk, etc. The foods should be cut fine on the plate, well chewed, eaten slowly, and you should lie down for about an hour after each meal, and not eat when physically exhausted or when under mental strain without first resting for a time.

The best foods to take are any of the well-cooked cereals, using plenty of fresh cream and a moderate amount of sugar with them; eggs in any form, taking at least four in the course of a day. Fresh fish, boiled or broiled, about three times in a week; beef, lamb, mutton and chicken, roasted or broiled; beef tongue or heart, ham and bacon, one or more times a day, and these should be of tender quality; bread, crackers, rolls and cake, not too fresh, should be eaten twice a day, and effort should be made to use as much fresh butter on them as possible, as well as on all of the other foods; salads with plenty of olive oil and very little vinegar and salt taken once a day; the best vegetables are plain or sweet potatoes, mashed or baked; peas, beans and lentils; dried, ground or whole fresh corn, and occasionally a little mashed turnips, spinach, carrots, all of which should be thoroughly cooked; desserts made of milk, eggs, cream and cereals can be taken, but no fruits or berries; Neufchâtel and Philadelphia cheeses are allowable.

As will be explained, a division of these cases should be made into the mild or moderate one that recovers on ambulatory treatment, and those in whom bed treatment is advisable to initiate in the beginning. In those who are about, attention should be paid and advice given on those hygienic measures that build up physical strength. Hot baths should not be permitted, although the spinal hot douche answers at times for instances of insomnia. A morning cold spray or rub with a cold, wet towel is beneficial. These patients should retire at an early hour, sleep in a well-ventilated room, and arise late. Certain carefully selected exercises should be advised which are not to be too strenuous. Patients should be taught the proper mode of breathing and standing.

Special Treatment.—These pertain particularly to mechanical measures employed for the purpose of supporting the prolapsed viscera, and measures employed for the development and increasing the tone of the abdominal muscles. The mechanical measures are fully described in Chapter XII. In the same chapter will be found detail pertaining to massage and vibration, electricity, electric vibration and the active exercises. In this connection may be added that vibration and electricity, particularly the use of the sinusoidal currents, answer to good purpose in these cases and also for the treatment of constipation when atony of the colon is mainly responsible for it. In a minority of the cases, the morning and evening routines of special exercises are most efficacious in the way of giving permanent beneficial results. Since these can do no harm, and always improve the general state of health, they should be advised in all cases, even should the local benefit from them in the way of relieving symptoms be slight or absent.

Medical Treatment.—The main rôles that medicines have in the care of these patients are those of tonic measures for a short time, and those for the relief of the neurological symptoms for the time being. In the first, the most valuable drug is nux vomica or strychnine, which can be employed after the meals and should always be administered in the largest possible doses. Five-drop doses of the tincture nux vomica or $\frac{1}{60}$ grain of strychnine are not of much value, but sometimes most signal benefit is derived from 10 to 20 drops of the tincture, or $\frac{1}{20}$ grain of strychnine at a dose. Results with these should not be expected too soon, and usually only come after a few weeks of steady administration. The benefits seen are less dilatation of the stomach and a better tone to the general body particularly of the neurological system. Unless the anemia is pronounced (in which instance the astringent forms of iron would be most useful), the best forms of iron, arsenic or manganese to employ are: liq. ferri albuminata; liq. ferri

PLATE LVI.

Author's corset on a slim woman, a case of attenuated and prolapsed stomach ıd palpable right kidney. Hook and eye steels on the stomach side of the ıdomen. Laced in the midfront and closed in the back. Two sets of laces used; e first, beginning at the bottom and bringing the corset tight together up to the nbilicus; the second, running from the umbilicus to the top and being loose so as obviate all waist line pressure and permit of full diaphragmatic breathing.

peptonatum cum mangano; ferrum redactum; liq. potassii arsenitis in small-sized doses, and manganese dioxide. To control the local and neurological symptoms the depressing bromides may be used, but if so only in signal cases and then the dose should be small. Since in the beginning of treatment some extra means to relieve the sensory gastric and other symptoms are generally necessary, the following are recommended:

In myasthenia, neuroses and anemia:—

℞ Tinctura nucis vomicæ ..... 12.0 ʒiij
Liq. ferri albuminata ..... 150.0 ℥v
Fiat et Sig.: Take two teaspoonfuls after meals in water.

Or,

℞ Zinci valerianata ..... 5.0 gr. lxx
Ferri redactum ..... 4.0 gr. lx
Fiat cap. no. xx.
Sig.: Take one after meals.

Or, in marked anemia:—

℞ Strychninæ sulphatis ..... 0.07 gr. j
Ferri sulphatis ..... 4.0 ʒj
Kalii carbonatis ..... 8.0 ʒij
Fiat capsules or soft pills no. xxx.
Sig.: Take one, one-half hour after meals.

When constipation and neurosis are features:—

℞ Tinctura rhei,
Tinctura valerianata .....āā 10.0 ʒiiss
Fiat et Sig.: Take twenty drops in water after meals.

Or, when constipation and anorexia are present:—

℞ Ext. cascara sagrada,
Fldext. condurango .....āā 15.0 ʒiv
Fiat et Sig.: Take twenty drops before meals in water.

For anorexia:—

℞ Tinctura nucis vomicæ ..... 10.0 ʒiij
Elixir gentian .....q. s. 100.0 ℥iij
Fiat et Sig.: Take one teaspoonful (or two) before meals in water well diluted.

For anorexia and anemia:—

℞ Tinctura nucis vomicæ ..... 9.0 ʒiiss
Elixir tinct. ferri chloridi et gentian..... 90.0 ℥iij
Fiat et Sig.: Take a teaspoonful before meals in water.

For the relief of constipation, when massage, electricity, exercise, diet and hydrotherapy fail and operation is not indicated, the use of the pills or tablets recommended at the end of Chapter X or plain cascara are preferable. Sodium phosphate and aloes, as suggested by

Glenard, may be employed, but it is best not to use the saline cathartics or aloes regularly. Instances of hyperchlorhydria are best relieved by the alkalies, and those of subacidity by the tonics and hygienic measures. In my experience the extract of malt preparations are most valuable constructors and neurological tonics in these cases. Other prescriptions that have been recommended are:—

(EWALD.)

℞ Tinctura nucis vomicæ	20.0	ʒvj
Resorcini	4.0	ʒj
Tinctura cinchonæ comp.	90.0	℥iij

Fiat et Sig.: Take ten to fifteen drops every two hours.

(PEPPER.)

℞ Creosoti, U. S. P.	0.4	gr. vj
Sodii bicarbonatis	7.0	ʒiss
Pulveris acaciæ,		
Sacchari ..... āā	q. s.	
Spr. lavandulæ comp.	8.0	ʒij
Aquæ	90.0	℥iij

Fiat et Sig.: Take teaspoonful after meals.

(MUSSER.)

℞ Acidi carbolici	0.4	gtt. vj
Sodii bicarbonatis	8.0	ʒij
Spr. ammon. aromat.	15.5	ʒiv
Spr. chloroformi	8.0	ʒij
Mist. rhei et menthæ	90.0	℥iij

Fiat et Sig.: Take a teaspoonful after meals and at bedtime.

(LOCKWOOD.)

℞ Chloralis hydratis	4.0	ʒj
Sodii bromidi	10.0	ʒiiss
Aquæ chloroformi	125.0	℥iv
Spiritus anisi	0.4	gtt. vj

Fiat et Sig.: Take a teaspoonful in water after meals, three times a day.

Ambulatory and Bed Treatments.—By persistent treatment the mild and moderately severe cases of splanchnoptosia are relieved of the subjective symptoms of the condition. A proportion of these, possibly about one-third, are returned to sustained health, but of course with more or less prolapse continuing. Obviously, being essentially a chronic condition, beneficial results of a substantial character are only accomplished after a length of treatment and observation lasting from three months to a year. In the other two-thirds a more or less prolonged attention is required to keep them in health sufficient for practical purposes. Even with many of those who had reached the stage of apparent chronic invalidism or inability to work, most gratifying results are often obtained. But there is a proportion of cases,

usually made up of the instances of long-standing marked prolapse of a complex make-up, floating kidney, prolapsed liver, the Landau cases developed successively by a number of pregnancies, or those in whom surgical conditions exist, in which the ambulatory treatment gives but poor and unsustained results. Excepting those in whom surgery would be indicated, these are best helped by the bed treatment followed by ambulatory care of the condition. Among these also in which bed treatment is indicated are the cases that have been treated while up and about and have not made sufficient improvement, and those of the severe conditions in which subsequent short runs of bed treatment (two weeks' duration) are desirable each year; the best time being in the midwinter after the Christmas holidays, namely, January or February.

The bed treatment in all of its essentials is that of the "rest cure," excepting that the element of building up the general nutrition is a more prominent feature ("rest and food cure"). The seclusion of the patient should always be strict, because the more sternly this is maintained, the fewer the visits of relatives and indiscreet friends into the sick room, the better are the results. For obvious reasons, a general hospital, even when a private room is employed, is not as good as a sanitarium, or, when conditions can be properly instituted and maintained, treatment in the home. An intelligent nurse, gentle yet insistent in carrying out instructions to the letter, and for the time in absolute authority on all that pertains to the patient, and the patient properly isolated away from observing the home environments, are essential. Among some of the details of treatment are a daily, cold, general and spinal spray or immersion followed by a salt or alcohol rub; hot moist applications to the abdomen, changed about every two hours, and kept up until the symptoms of abdominal distress are relieved; massage of the descending colon ten minutes three times a day to relieve the constipation; the abdominal exercises toward the end of the treatment; daily irrigation of the colon by a to and fro current in treating a mucous colitis, using a normal salt or weak silver nitrate solution; the use of electricity in impressionable patients; and the diet and medication.

Of the diet during the time in bed, the plan should be the use of semisolid or fluid foods rather than solid foods like those of meats. Fish and poultry, however, are of much benefit all of the way through. The meals should be given at three-hour intervals, consisting mostly of cereals with cream, soft-boiled eggs, rolls, butter, marmalade, the soft vegetables, farinaceous desserts, and milk or half milk and cream.

Effort should be made to give as much butter and fresh cream during the day as possible. Other liquids and fruits are not allowable.

The full treatment should take up about a month, and the return to everyday life should be gradual. As a rule in every case, the first week after the rest cure shows a decided slump in the patient's condition, the patient losing a little in weight and complaining again of gas and distress. These symptoms soon pass away, but it is well to warn the patients of them in advance, so that they would not become discouraged. As a rule, under this plan of treatment, the patients gain about 10 pounds in weight during the bed treatment with a steady gain in weight following for from two months to a year. The stomach and other organs are usually maintained at a higher level, although this cannot always be depended upon, and thus the therapeutic matters mentioned in the ambulatory treatment must be maintained in a continued way for some time. There is no doubt, as Lockwood has emphasized, that by this treatment the results obtained are decidedly better than any so far devised for the purpose of holding up the stomach.

Surgical Treatment.—It has lately been a matter of contention as to whether splanchnoptosia is a medical or surgical condition. This can never be settled unless finer pathological distinctions are made in the cases seen. There is no doubt that in the vast majority of cases it is strictly medical. Particularly is this true when more than one organ is involved as is usually the case. On the contrary are the cases, like floating kidney with Dietl's crisis, in which surgery offers by far the best means for relieving the symptoms that are due to the one organ prolapse. In every case, however, it is advisable to first try the medical measures or the rest and food treatment before even thinking of operation.

The instances in which surgery offers possibilities of results better than those of medicine are: floating kidney accompanied by intermittent hydronephrosis or Dietl's crisis; a displaced kidney or spleen pressing upon the other organs or upon the sympathetic or genitocrural nerves or upon the ovarian vein, causing subsequent ovarian disease; also tortion of the pedicle of the spleen with swelling and gangrene, and a few cases in which a dilated pouch of the pyloric region hangs well into the pelvis. In cases of marked constipation or obstipation for organic reasons of a mechanical nature, much in the way of relief may be obtained by surgery. Among these instances may be mentioned: congenital deformities, strictures, tumors, foreign bodies, fecal impaction, adhesions, angulations, volvulus, diverticula,

prolapse of the colon, sigmoid flexure, or rectum, as well as the rectum and anus conditions.

In operations upon the stomach for gastroptosis flattering reports have been made by Rovsing (56 gastropexies with good results in each) and by Beyea by his method (11 cures in 11 cases). The facts are that in the great majority of cases operations for this purpose upon the stomach are not capable of giving such good results as are the medical treatments. There are a few, nevertheless, of very marked looping in which most of the organ is like a narrow channel in contact with the left abdominal wall, in which operation might serve to good

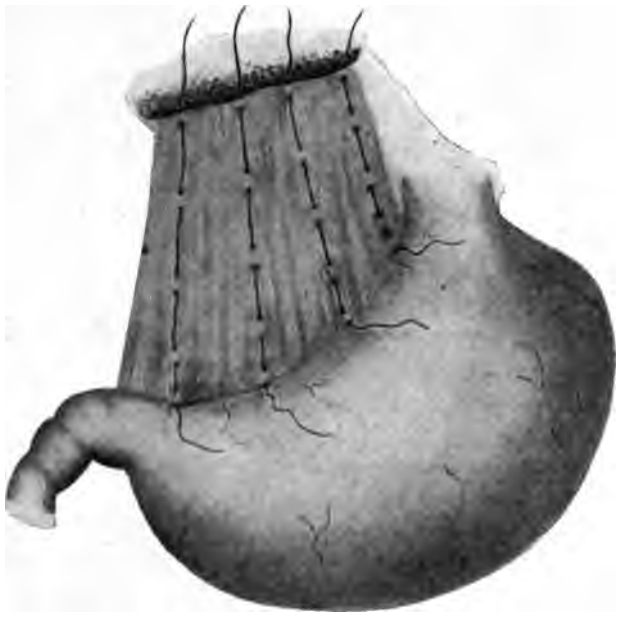


Fig. 105.—Suture of the gastrohepatic omentum to secure elevation of the stomach in gastroptosis (Beyea). The first suture is introduced by beginning above in the strong tissue of the attachment of the ligament to the liver, the needle including considerable tissue. Grasps at short intervals from above downward are then taken until a position just above the gastric vessels at the lesser curvature is reached. Four to six sutures are used (about an inch apart), carried as high and low as possible. When these are tied the lesser curvature is almost in contact with the under surface of the liver.

purpose in the way of relief, but gastro-enterostomy, for obvious reasons, even in the face of marked dilatation, should never be performed; the Beyea method of suturing the gastrohepatic and gastrophrenic ligaments, which only elevates the organ and does not interfere with its motility, being the choice on all occasions. Nephropexy, by

stitching the parenchyma in addition to a free dissection of the fibrous and fatty capsule, has practically no mortality, and is capable of affording a practical attachment in about one-third of the cases of floating kidney, the medical measures answering best for those in which the organ is not so freely movable, or has recurred after operation. It must be recalled that a successful nephropexy does not cure a splanchnoptosia, and thus should only be advised when definite kidney symptoms exist.

As regards fixation of the liver various operations have been devised, prominent among which are the methods of Billroth, Franke and Langenbeck. These, however, should not be performed, excepting in the rare cases in which the liver is markedly descended. The mortality rate from them is decidedly higher than the other organ operations for prolapse; the successful cases reported being too few to gain any definite ideas as to this. Rovsing reports 18 hepatopexies with good results. Unless torsion of the pedicle or presence upon other organs exists, prolapsed spleen is a medical condition, splenectomy to be considered as being on the order of an emergency procedure.

In enteroptosis most of the operations that have been done have been upon the transverse colon, sigmoid flexure, sigmoid, cecum and rectum, and usually for the purpose of relieving an obstinate constipation. In by far the largest number of cases of coloptosis, operation is not indicated, and in these colonic fixation should be looked upon as adding one pathological condition upon another. Still, operation is usually called for when the entire large bowel is down, or when a V-shaped sagging of the transverse colon is marked and a kinking obstruction exists. Prolapse of the small intestine is a non-surgical condition.

References.

[1] Rudolph Virchow's Archiv, vol. v, 1853.

[2] A. Keith: London Lancet, March 7 and 14, 1903.

[3] Byron Robinson: "Splanchnoptosia," Medical Standard.

[4] Meinhert: Sammlung klin. Vorträge, N. F., Nr. 115 u. 116, Leipzig, 1895; Centralblatt f. innere Med., 1895, Nr. 43 und ebenda, 1896, Nr. 13 u. 14.

[5] Modern Clinical Medicine, "The Digestive Diseases," p. 264.

[6] Kemp: "Atonia Gastrica," Rose and Kemp, p. 7.

[7] Bassler: "Prophylactic Measures Guarding Against the Development of Landau Cases of Splanchnoptosia," Therapeutic Gazette, September 15, 1907.

CHAPTER XXVII.

Stomach Conditions in Diseases of Other Organs.

THE majority of diseases are accompanied with symptoms referred to the digestive system. These, however, are not primarily due to affections of the stomach or intestines, and are usually discussed in the symptomatology of the various diseases. In some of these, particularly in the afebrile and the more chronic forms of disease, the gastro-intestinal symptoms may be marked features in a case, and often group the manifest symptoms so as to bring the case under medical observation. Since mistakes are always liable to be made in the way of diagnosing and treating diseases of other organs for those of the gastro-intestinal canal, it would not be amiss to give a brief description of the gastro-intestinal symptoms or stomach conditions that may be present in the more common forms of general body diseases, and give a short *résumé* of the important symptoms and differential points in those cases that often simulate gastro-enteric disease.

DISEASES OF THE INTESTINES.

Indicanuric Conditions.—Particularly of the German authors, Nothnagel, relying upon the experiments of Jaffé and his own clinical observations, established an important distinction between the large and small intestines as related to indicanuria. Indol, they say, originates in the putrefaction caused by bacteria in the terminal portion of the small intestine, and does not originate in the large intestine not even in cases of habitual constipation, although constipation is commonly present in the cases and the intake of indican into the circulation is controlled when the bowels are kept moving. I have already stated that the condition of the stomach primarily is not an important factor in its production, because almost as many cases of indicanuria with excess or normal gastric secretion are seen as with a subacidity or anacidity. Low gastric secretions should be looked upon as a result of the indicanuria rather than the cause of the latter. The instances of red indican and urorosein or indolaceturia, as Herter has

described them, for practical purposes, may be considered on a par with indicanuria.

Among the stomach conditions that may be noted in these affections as a result of indicanuric putrefactions in the gut or manufactured elsewhere are: sensory neurosis of a mild type, with a high and then a depressed HCl secretion, and myasthenia or atony. The gastro-enteric symptoms most commonly met with are epigastric weight, fullness, and distress, more or less at all times and moderately intensified after eating, disagreeable odor to the breath and bad taste in the mouth, feeling of lassitude and debility after meals, much flatulency in the intestines and constipation, and persistent back pains. With these are observed the results from the dietetic, chemical, and bacteriological examinations of the stools, and the constitutional symptoms of debility, emaciation, neurosis, anemia, and, in long-standing cases, affections of other organs, such as the kidneys, liver and heart, and finally intractable neurasthenia.

Intestinal Indigestion.—Together with the above, are seen states of intestinal indigestion due to lack of bile, pancreatic or intestinal secretions. Among the symptoms noted are the gastric manifestations of nausea, vomiting, flatulence, and the sensory disturbances of the stomach. The stools usually contain increased amounts of incorporated mucus, may be acid instead of alkaline, and may be fluid, light in color, foamy and of a butyric acid odor (saccharobutyric putrefaction). In instances of intestinal colic, the acute periodical pains accompanied by general disturbances in the nervous system are distinguishing features; in the latter also, whether due to functional or organic conditions, the marked gaseous distention of the bowels associated with loud rumbling or borborygmi are present. In lead colic the constipation and intense abdominal pains, the anemia and pallor, the blue margin of the gum or about the anus, the paralysis of the extensor muscles of the forearm, the high-tension pulse and hard arteries, together with the history of occupation, are helpful in diagnosis.

Habitual Constipation.—In cases of habitual constipation from any cause, gastric symptoms are common. These comprise mostly, nausea and vomiting, sensory gastric distress, and anorexia for the time being. The history of irregularity of stools, possibly alternating with a diarrhea, is most helpful in diagnosis. The other symptoms that are commonly present are: heaviness, sleeplessness, vertigo, headaches, the nervous symptoms, continuous back and colicky abdominal pain, a feeling of localized pain in the sigmoid, the noting of impactions, slight fever, palpitations and irregularity of the heart's action.

Enteritis.—These comprise the cases of acute inflammatory diarrhea, such as enterocolitis and ileocolitis, and the infectious conditions of typhoid fever, cholera, dysentery, etc. In these the symptoms are mostly intestinal and general, although anorexia, those of irritation of the stomach (nausea and vomiting), jaundice, coated and dry tongue, abdominal distention and tenderness, and pains are common. In the chronic catarrhal forms, including colitis, the diagnosis is mostly made from the history, the stool examinations, the more strictly intestinal symptoms, and those of a general nature. Most cases of intestinal ulceration are accompanied by the history of syphilis, tuberculosis, acute or chronic infections, or constitutional or toxic diseases and cancer, the local involvement being suggested by the steady diarrhea and consequent general symptoms. The separation of cases of appendicitis from other forms of enteric inflammations need not be entered into here, and the diagnosis between appendicitis and gastric and duodenal ulcers is found in Chapter XX. The diagnosis of the acute and chronic colonic conditions are made mostly by feces examination.

Intestinal Obstruction.—Intestinal obstruction due to ileus, occlusion, stricture, constriction, compression, incarceration, or strangulation may simulate the severe, primary gastric conditions in the first hours or days as the case may be, but usually are diagnosable sooner or later by attention to special diagnostic signs pertaining to them. It may be mentioned that the chronic forms of obstruction are generally more confusing than the acute, and that in all obstipation, nausea, followed by vomiting of foods and then fecal matter, marked general abdominal distention, prostration and collapse are important abdominal symptoms.

Peritonitis.—Acute diffuse peritonitis, such as follows perforating ulcer of the stomach or duodenum, also develops from perforating typhoid or uremic ulcer, acute enteritis, infarctions, intestinal obstructions, appendicular disease, from perforation or traumatism of the colon; acute, phlegmonous or gangrenous cholecystitis; rupture of the gall-bladder, rupture or leaking abscess of the liver, rupture of a suppurating mesenteric gland into the general peritoneal cavity, rupturing abscess of the pancreas, ulceration or rupture of the urinary bladder, suppurating and gangrenous ovarian cysts, pyosalpinx, and infections from the Fallopian tubes, or the uterus in post-partum cases. The attendant local and general symptoms of extensive inflammation, paralysis, septicemia, toxemia, etc. need not be entered into here.

The cases of acute circumscribed and the chronic form of peritonitis may be most confusing in some instances. In the first, the vomiting, elevation of temperature, quickened pulse, local muscular

rigidity and deep tenderness, tumor formation, and hyperleucocytosis and high differential count are often helpful. These also pertain to the omental, perigastric, pericolic, strictly peritoneal, retroperitoneal and subphrenic abscess conditions. In the chronic forms of peritonitis, which may be localized or diffuse, the history, the noting (either by medical or surgical means) of disease in special organs, like the genital organs, appendix, gall-bladder, etc., contain the main distinguishing points for the exclusion of gastric disorders. Tuberculosis of the peritoneum, the primary malignant and non-malignant tumors, hydatid disease, and secondary malignant disease need only to be mentioned.

DISEASES OF THE GALL-BLADDER.

The variability of the symptoms of cholecystitis and the commonness of cholelithiasis (5 to 10 per cent. of all necropsies), the close situation of this organ to the pyloric extremity of the stomach and upper duodenum, the frequent existence of gall-bladder with gastric conditions, and the numerous cases of the latter in practice, often make the clinical separation of conditions of these two organs a most difficult matter. This is truly unfortunate, because, practically, there are no two organs in the human abdomen in which means for making positive distinctions of separate organ disease would be more welcome. Almost daily, cases of uncomplicated gall-bladder disease present themselves most apparently as distinct gastric affections (generally of a neurotic nature), and, on the other hand, certain gastric conditions, like the spasms and other nervous affections, look clinically like those of gall-bladder disease. In the majority of gall-bladder disease cases, diagnosis is possible by the noting of symptoms more distinctly referable to the gall-bladder or ducts, and only these will be enumerated.

Cholangitis.—Acute catarrhal jaundice usually follows in the wake of a gastro-intestinal catarrh of an acute nature, due either to dietetic indiscretion or alcoholism, or as an accompaniment of certain infectious diseases, such as typhoid fever, pneumonia, etc. If present, the onset of jaundice as a rule is slow and progressive, but even before this is noticed, such symptoms as anorexia, bad taste in the mouth, coated tongue, foul breath, post-meal epigastric distress, flatulence, nausea and perhaps vomiting may have existed. The diagnosis is usually made on the appearance of jaundice, the bile in the urine, and the acholic stools.

The suppurative form of acute cholangitis is more difficult of diagnosis, although, when the constitutional phenomena, such as chills,

fever, sweats, emaciation, diarrhea, jaundice, and the others of pain over the gall-bladder region, swollen gall-bladder, hyperleucocytosis, high differential count and enlarged spleen, be present, the diagnosis is suggested.

Chronic catarrhal cholangitis is usually suggested by rather constant disturbance in the region of the gall-bladder and relapsing attacks of jaundice. These cases often appear as those of chronic gastritis, in fact the latter is probably the cause of the condition in most of the cases, excepting those due to biliary obstruction, the suppurative conditions, gall-stones, acute yellow atrophy of the liver, etc.

Cholecystitis.—The inflammatory conditions of the gall-bladder of a catarrhal nature may be considered as acute and chronic in character, both types usually being accompanied by a cholangitis. As we understand these conditions to-day, acute cholecystitis is due to bacterial infections (mainly typhoidal), and is important because the gall-bladder may become empyemic, ulcerated, or gangrenous, or the condition is so commonly the forerunner of gall-stone formation. Chronic cholecystitis may be a residual condition after an acute cholecystitis, may be chronic from the start, and clinically it is almost impossible to differentiate it from cholelithiasis, because chronic cholecystitis and cholelithiasis are often present at the same time, and if not the symptoms of both are often identical.

The symptoms of acute cholecystitis are so variable and the stomach manifestations may be so prominent a feature in a case that difficulty in diagnosis is always encountered. Naturally, if following a typhoid fever or long-standing bacterial conditions in the small intestine there is present an enlargement of the gall-bladder, this would lead one to the diagnosis. In these, a tenderness over the gall-bladder usually exists with more or less constant epigastric distress and back pains, perhaps slight nausea, and the sensory gastric symptoms. When initial nausea and vomiting, fever, localized pain and tenderness in the region of the gall-bladder, spasm of the overlying abdominal muscles and enlarged gall-bladder exist, the diagnosis is easy. It is as these are separate in character and grouping from the true gastric conditions that differential diagnosis is made possible. Still, instances of both are common in clinical work, and here the complex diagnosis can only be made after extensive observation. Jaundice, as a rule, is not a part of uncomplicated cholecystitis.

Cholelithiasis.—The symptoms of gall-stone disease are: chronic recurring indigestion which resembles in clinical make-up hyperacidity or states of hypersecretion and chronic gastritis or chronic enteritis,

but differs from these in the absence of the characteristic test-meal and feces analysis; gall-stone colic (present in about one-half of the cases), followed by jaundice and deep tenderness in the biliary triangle; enlargement of the gall-bladder (40 per cent. of the cases); symptoms of obstructive cholecystitis, and the complications and sequelæ of cholelithiasis (pericholecystic adhesions, biliary fistulæ, intestinal obstruction). When only one of the conditions exists, differential diagnosis between the neurotic gastric conditions and atypical instances of gall-stone disease is most difficult, and can only be made by extended observation or surgery. In gall-stone disease hyperchlorhydria, simple gastralgia, and pyloric spasms are common resulting gastric conditions.

Biliary Carcinoma.—Cancer of the gall-bladder and biliary ducts of a primary nature usually follows cholecystitis and cholelithiasis or long-standing indigestion of an obscure nature. When jaundice occurs it is generally chronic, the gall-bladder is enlarged, a tumor is palpable, and the general health is impaired. The cases when seen are usually well enough advanced for diagnosis, chronic or recurring jaundice being a prominent feature in the case. Excepting by means of surgery, early diagnosis of this condition cannot be made. A chronic cholecystitis or long-standing cholelithiasis in an individual over forty years of age should be considered as a cause of the development of carcinoma. Biliary adhesions binding down the gall passages may, by causing a chronic jaundice, simulate cases of biliary cancer; the distinction is usually made by the absence of the general symptoms of malignant disease, the long course of the disorder and the absence of local tumor formation.

DISEASES OF THE LIVER.

Acute Yellow Atrophy.—The main symptoms in this disease are: gastro-enteric catarrh followed by jaundice, which deepens into a very dark yellowish or bronze-like skin; headache, mental confusion, restlessness, delirium, coma and perhaps convulsions; the gastro-intestinal symptoms of anorexia, coated tongue, nausea, vomiting, constipation, hematemesis, melena, hemoptysis; urinary and cutaneous hemorrhage; rapid, feeble and low-tension pulse; dilatation of the pupils; irregularity in respirations; and at first an enlargement and finally a diminution in the size of the liver. These cases at first simulate acute gastro-enteric catarrh accompanied by jaundice, or a cholecystitis, but as a rule the intensity and rapid deepening of the general and special symptoms leads one to the condition. Death usually occurs inside of two

weeks, one-half of the cases terminating fatally between the fifth and tenth day.

Perihepatitis.—This is almost always a secondary disorder. The main symptoms are those of local pain of an acute nature, and audible and palpable friction. Nausea and vomiting may occur in case the stomach, duodenum or gall-bladder be implicated in the inflammation.

General chronic perihepatitis, or "sugar-iced liver," is a rather uncommon condition and usually not diagnosed during life. Still, diagnosis is suggested when the following symptoms are developed: fullness, weight and pains in the upper abdomen; ascites, edema of the legs, transitory jaundice, and symptoms of chronic interstitial nephritis, arteriosclerosis, pericarditis, or pleuritis.

Hepatitis.—The symptoms here are those of liver pain and tenderness, nausea and vomiting, constipation or foul-smelling, loose movements, headache, restlessness, irritability, mental depression, disturbed sleep, sallowness of the general complexion, enlargement of the liver, urine of high specific gravity containing abundance of urates or uric acid and a trace of albumin, slight fever, chills or chilliness, anorexia, nausea and possibly vomiting.

The suppurative forms are the above with the symptoms of sepsis added, namely, septic temperature, marked chills, sweats, hyperleucocytosis and a high differential count of polynuclear leucocytes.

Chronic interstitial hepatitis, or cirrhosis of the liver, may early in the case be mistaken for that of a chronic gastric or enteric catarrh. This is due to the fact that this stomach and intestinal condition often accompanies hepatic cirrhosis and the commonness of the symptoms of nausea, anorexia, eructations, vomiting, constipation, diarrhea, and epigastric fullness. Still, the history of chronic alcoholism, enlarged or contracted liver, mild jaundice, ascites, edema of the lower extremities, hemorrhages, evidences of the establishment of a collateral circulation, etc. usually establishes the diagnosis. Biliary cirrhosis, tuberculosis, syphilis, actinomycosis, carcinoma, sarcoma, benign growths and cysts, and hydatid disease of the liver should be mentioned and need not be entered into here.

DISEASES OF THE PANCREAS.

Cases of acute hemorrhagic pancreatitis are most liable to be diagnosed as intestinal obstruction of an acute type, but, in the first, stercoraceous vomiting and visible intestinal peristalsis are not present. Other cases again may be diagnosed as perforating ulcer in the upper

abdominal zone or even non-perforating ulcer. In pancreatitis, however, the quick onset of symptoms and course of the disease, the digestive symptoms of severe nausea and vomiting, sudden pain of great severity located above the umbilicus and in the back; the marked spasm of the abdominal muscles accompanied with exquisite tenderness and pain requiring enormous quantities of morphia to control it; symptoms of shock, constipation or diarrhea; jaundice, hyperleucocytosis, glycosuria, the Cammidge test, and tumor formation will sooner or later lead one to the proper diagnosis. In the stage of gangrene, the fever (usually not present in the acute stage, but it is in one-half of the gangrenous), marked hyperleucocytosis (18,000 to 33,000), and the presence of a tumor mass all following the history of the acute stage may be helpful. Suppurative pancreatitis, which may follow the acute hemorrhagic inflammation, or be a complication of pancreatic lithiasis, a pancreatic cyst or cancer, or bile passage or duodenal inflammation, is usually more difficult to diagnose early than the more simple acute forms. This is mainly due to the more chronic course found in about one-half of the cases. In the acute cases and later in the chronic forms, the symptoms of sudden onset, intense pain, vomiting and collapse, early elevation of temperature, chills, sweats, hyperleucocytosis and high differential count and tumor would be helpful.

Chronic parenchymatous and chronic interstitial pancreatitis are very liable to be overlooked or diagnosed for gastro-enteric or metabolic affections. The reasons for this are the chronicity of the course, the few definite symptoms accompanying these conditions, and their common association with gall-stones, carcinoma or cirrhosis of the liver, arteriosclerosis and diabetes mellitus. Among the more definite symptoms that might lead to the suspicion of a chronic pancreatitis are: the existence of the above-mentioned conditions; a chronic history of nausea, vomiting and epigastric pain; loss of weight and strength; fatty stools and high loss of albumin from foods in digestion and resorption; glycosuria, and positive results from the Cammidge tests.

Pancreatic Calculi.—This condition is diagnosable to a slightly better extent than the chronic forms of pancreatitis. The most frequent symptom is pain, steady, intermittent, or colicky, located in the epigastrium and under the left costal margin in the mammillary line and radiating to the left side of the spine or to the left shoulder blade (in biliary colic the pain is on the right side near the umbilicus or in the median line; also this pain radiates to the right shoulder blade and shoulder); passage of calculi following the attacks of colic, vomiting

during the seizure, temporary jaundice, symptoms of diabetes mellitus, steatorrhea and azotorrhea.

Pancreatic Cysts.—These are diagnosed as a rule by the noting of a rounded, fluctuating tumor situated in the epigastrium, usually to the left of the median line. Small cysts are not palpable from without and usually escape detection during life. Sudden disappearance of a cyst occurs from rupture into the peritoneal cavity. Pain is a most constant feature and may be present before the cyst is large enough to be palpable. The symptoms of pressure on the adjacent organs are: those of stomach distress after meals and gastric intolerance for foods; anorexia, vomiting, colicky pain, constipation, jaundice, ascites, and functional disturbance of the pancreas. Sugar in the urine may or may not be present, and loss of weight and strength is the rule. The diagnosis of the condition usually lies between cysts connected with the other abdominal structures, echinococcus of the left lobe of the liver, distended gall-bladder, hydronephrosis and abdominal aorta aneurism.

Carcinoma of the Pancreas.—Cancer and sarcoma of the pancreas are diagnosable only after considerable observation, the constant presence of glucose in the urine, positive Cammidge tests, the noting of an immovable, irregular-shaped tumor mass, chronic jaundice, symptoms of pressure upon superior mesenteric and splenic arteries or veins or upon the portal vein, the rapid fatal course including marked emaciation and cachexia, pain and the gastro-intestinal symptoms of distaste for food and aversion to meats, post-meal gastric distress, eructations, nausea and vomiting, fatty or bulky stools, and involvement of the adjacent abdominal organs in the growth. Tuberculosis and syphilis of the pancreas need not be entered into here.

DISEASES OF THE KIDNEYS.

Nephritis.—Acute and chronic parenchymatous and intestinal nephritis are diagnosed by urine analysis and the special symptoms referable to these affections. Gastro-intestinal work should always include a complete chemical examination of the urine in all cases. The stomach conditions that are met with in nephritis are in the acute parenchymatous types; a decrease of gastric secretion both in the hydrochloric acid and enzymes and a hyperchlorhydria in intestinal nephritis; hypermotility, gastric catarrh, nausea and vomiting in the frank acute form; and in the chronic forms, anorexia, post-meal distress, flatulence, coated tongue, occasional feelings of nausea and pos-

sibly vomiting, thirst and diarrhea. Amyloid disease of the kidneys usually follows long-standing suppurations or tuberculosis, and the urine and physical examination of the kidneys, liver and spleen are usually helpful in suspecting the presence of this condition. The pyogenic affections, such as pyelitis, ascending pyelonephritis and hematogenous and traumatic infections are diagnosable best by urinalysis and the constitutional symptoms. Perinephritic abscess and the ureteral conditions need not be included. Acute dilatations of the stomach are occasionally seen in eclampsia.

Tuberculosis of the Kidney.—This disease rarely causes confusion with the gastro-enteric affections. It may be suspected in acute miliary tuberculosis when oliguria or albuminuria suddenly develops. In the primary infections, the disturbances of urination, the examination of the urine (particularly the noting of the presence of tubercle bacilli), cystoscopic examinations of the bladder, ureteral orifices and ureters, the local swelling and pain, the constitutional symptoms, fever and rapid pulse are important. The gastro-intestinal symptoms are usually late and consist mostly of anorexia, diarrhea and bulimia. Tumors of the kidney need not be included.

Renal and Ureteral Calculi.—Instances of this condition may be mistaken for the other kidney conditions, disease of the spine, colonic colic, and gall-bladder or pancreatic calculi. The diagnosis is made by exclusion, the character and radiation of the pain during the seizure, the passage of bloody urine, anuria, and the X-ray.

DISEASES OF THE HEART AND ARTERIES.

These are diagnosable by the many symptoms pertaining to these structures of the body. Secondary chronic gastritis is common in advanced heart conditions, and at these times the test-meal analysis usually displays an achylic stomach, particularly when the heart compensation is being lost.

Arteriosclerosis.—Gastro-intestinal symptoms are, at times, found in patients who have a generalized arteriosclerosis, or in those in whom the splanchnic arteries are solely or mainly affected. Among these are: abdominal pain of a paroxysmal nature lasting for a few moments and coming at various times each day; dull aching soreness and throbbing in the abdomen (symptoms that are increased on exertion); abdominal distention and belching; fullness and distress after meals; occasional nausea, vertigo, and an achylic stomach due probably to the waning of gastric secretion incident to age as well as to the local

interference with the circulation. The diagnosis is made by the examination of the arteries, the maintained high arterial tension, and the noting of the cardiac and renal conditions that usually accompany general arterial disease.

Functional Cardiac Conditions.—In the first instance certain of these may be mistaken for gastric disease, but the history and the noting of the special symptoms usually make the case plain. Among such as I have seen that have come under observation for gastric conditions are tachycardia, bradycardia, arhythmia, angina pectoris, and pseudo-angina, but all of these, excepting when some primary gastric condition was also present, have no special grouping or featuring of gastro-intestinal symptoms to warrant delineation.

Myocarditis.—The chronic forms of myocarditis not infrequently are accompanied with symptoms that bring the cases under observation for gastric conditions. Among such gastric symptoms are epigastric fullness, weight or pain ascribed to an indigestion, and post-meal distress of a sensory nature. The history, examination of the heart, etc., usually disclose plain signs of myocardial origin in each case.

Pernicious Anemia.—The weakness seen in this disease is commonly accompanied or preceded by nausea or vomiting, anorexia, and sensory disturbances. Diarrhea or constipation may also be present, and gastric analysis usually shows a subacidity, anacidity or achylia. High albumin loss of the foods is common; examination of the urine often shows a marked indicanuria, in about one-half of the cases albuminuria, and this with casts in about one-quarter. The diagnosis, of course, is made by the examination of the blood, a clinical procedure that never should be neglected in all instances of anemia.

Chlorosis and Secondary Anemia.—These conditions are easily diagnosable on the appearance of the patient and the blood examination. The gastro-intestinal symptoms that commonly are present are: morbid appetite or anorexia, nausea and vomiting, distress after eating, flatulency, constipation, and palpitation of the heart. These to a less degree are also seen in instances of secondary or symptomatic anemia from any cause. In chlorosis the largest number of cases have a subacidity, only a small proportion having an increase of secretion. But a strange feature, as Liwschitz has shown, is, that with the low secretion a decided increase in gastric motility generally exists. Gastroptosis is a common association with chlorosis. The following list representing the number of milligrammes of iron contained in 100 grains of the dry substance is appended for assistance in the dietetic treatment cure of these cases.

PERCENTAGES OF IRON IN FOODS.

White bread	1.4	Potatoes	6.2
Apples, sweet	1.7	Green pease	6.8
Apples, sour	2.1	French beans	8.5
Pears	2.2	Carrots	8.9
Cow's milk	2.3	Lentils	9.3
Goat's milk	2.5	Asparagus	10.5
Brown bread	2.5	Yolk of egg	18.3
Red currants	3.6	Green chicory	22.0
Rice	4.5	Cabbage	30.5
Barley	4.7	Spinach	40.0
Black grapes	5.8		

Leukemia.—The gastro-intestinal symptoms of this disease are usually seen late in the course and as a rule are not prominent features. Among these are nausea and vomiting, and flatulency. Occasionally a diarrhea is early and obstinate. The observation, blood and physical examinations seldom lead one astray in the clinical forms of this disease.

In Hodgkin's disease and splenic anemia, the chronicity of the disorder, enlargement of the lymph glands, splenomegaly, anemia of a moderate reduction in hemoglobin and both the red and white cells, hematemesis, pigmentation of the skin, and jaundice, are the main diagnostic points. The gastro-intestinal symptoms are those due to the anemia and the chronic constitutional effects on the system. As a rule the latter are not prominent features in the case.

DISEASES OF THE LUNGS.

Tuberculosis.—Symptoms in the digestive canal are present sooner or later in almost every case of well established tuberculosis. Sometimes the gastro-intestinal with the general symptoms are manifest before those of the respiratory tract, and not a few incipient cases are seen in which the chest examination is negative, in so far as definite physical signs are concerned, but in which the gastro-intestinal and general conditions are well established. Among these may be mentioned, coated tongue, a steady running anorexia in a person in whom the appetite had always been good, post-meal distress, eructations, nausea with or without vomiting, gastralgia, a possible gastric hyperacidity in the early course of the disease, from loss of general body tone, a myasthenia with submotility later on being liable to develop into a distinct atony of the stomach, enteralgia, constipation possibly alternating with diarrhea but a more steady diarrhea or tendency to loose movements later on, catarrhal enteritis, and the symptoms of colonic ulceration. As a rule, the gastro-intestinal symptoms are controlled with difficulty unless the disease causing their production had

been recognized and improvement had been made in the general way. Possibly the most unfortunate cases of pulmonary tuberculosis are those in which anorexia and gastric distress after the ingestion of foods are marked features in the beginning of the disease. I have often observed, in fact it is the rule, that in such individuals the foods cannot or will not be taken in sufficient amounts, and thus the prognosis for recovery is always poor. Other cases are seen in which appetite is a feature of prominence, and in these (when seen early enough) and those in whom an appetite can be worked up or at least sufficient amounts of food are taken, the results of treatment are generally better. There probably is no more difficult problem in medicine than that of maintaining a high feeding in the first class of patients, or those who later develop marked anorexia and gastric distress of a sensory nature. In many of these it is as if the toxins of tuberculosis cause a hypersensitiveness of the stomach, and the parent disease, being essentially chronic or progressive, makes feeding doubly difficult. Still, it must not be forgotten that gastric analysis of a large number of cases in the early stage shows a normal or increased degree of gastric juice secretion, and it is only when the disease is well advanced or mixed infection and fever exist that the secretory function runs down. In any infectious disease, a high fever for a short time or a low fever running for a length of time usually is accompanied by subacidity, anacidity or achylia. In tuberculosis too much attention should not be paid to changing the diet to meet the gastric analysis or the stomach symptoms. A much better plan is to change the forms in which the various articles of diet are taken, depending more upon those that can be given in a fluid, semifluid or finely comminuted form. These should be given at frequent intervals during the day, care being taken that those selected and their quantities should represent the highest caloric values in the smallest bulk, and that enough caloric units are given each day to more than maintain tissue equilibrium; the best standard being the highest tolerance of the individual. Hausmann has drawn attention to the fact that often in cases of incipient pulmonary tuberculosis, when no special or definite chest symptoms exist, examination of the contents of the morning fasting stomach will show the presence of tubercle bacilli swallowed during the night and making possible a diagnosis of the lung affection. I wish to add my confirmation to the value of these examinations, for in early cases I have observed the organisms in the empty stomach a number of times before cough and expectoration had developed; thus the author believes that these examinations are of much clinical value.

Asthma, emphysema, hay fever, pleuritis, pneumonia, and other lung conditions are sometimes accompanied with gastro-intestinal symptoms, but these require no special mention here.

Asthma Dyspepticum.—Asthma due to digestive disturbances was first described in children under this term by Henoch. Since then other observers have drawn attention to cases of dyspeptic asthma in the adult. The cases are represented in those of periodic attacks of asthma at long intervals in which the attack comes on after some indiscretion in eating, drinking or the use of tobacco, and the more chronic and continued forms in which the attacks of asthma appear without cause. The respiratory attacks are distinctly different from those of true asthma in that prolonged expiration is not a marked feature, the seizures are more intense in the difficulty of breathing (inspiration), and the general symptoms of cold extremities, cyanosis, and collapse are more of a clinical feature. Intense griping, cardiac pains, like those in angina pectoris, may be present. The condition is probably precipitated by a hyperesthesia of the stomach (Boas), although, in my opinion, it is mostly due to pressure of the fundic end of the stomach (gaseous) lifting the right dome of the diaphragm and pressing the heart forward and the left lung upward and diminishing the capacity of the left chest. These same attacks can be produced in some persons by over-inflation of the stomach. The conditions that are often present in these cases are gastric atony, gastroptosis, hepatoptosia, hyperchlorhydria, low or absent acidity, chronic gastritis, constipation, and arteriosclerosis. Treatment directed to these conditions usually relieves and cures many of the cases.

DISEASES OF METABOLISM.

Diabetes Mellitus.—Not a few cases of diabetes mellitus first come under observation for the treatment of gastro-intestinal disorders. Among the conditions and symptoms that have been noted are: anorexia, bulimia or polyphagia, dry mouth, thirst, sensory gastric disturbance, gastrectasia from the enormous quantities of food and liquids taken, gastric catarrh, constipation, diarrhea and steatorrhea. The examination of the urine for glucose, etc. (a matter necessary in the handling of all gastro-intestinal affections), together with the other symptoms, such as polyuria, emaciation, sweet taste in the mouth, boils, carbuncles, gangrene, neuritis, etc., always discloses the proper diagnosis. As a rule, however, most of the cases of diabetes mellitus have comparatively little or no gastro-intestinal disturbance other than constipation, and it is often surprising that even in extreme

types of the disease the gastric digestion remains so good; this may be due to the acid bodies present in the majority of these patients assisting digestion, or to the glucose content in the blood and secretions inhibiting fermentation and putrefaction.

Gout.—In cases of acute gout, loss of appetite, flatulence, and those symptoms of gastric hyperacidity may be present. In the chronic or irregular forms alimentary disturbances are the rule. Among the symptoms and conditions noted are: psoriasis of the tongue, parotiditis and recurring pharyngitis, hyperchorhydria and periodic gastrosuccorrhea, sensory stomach symptoms, low forms of acute gastric and enteric catarrh, constipation, acute colicky attacks followed by diarrhea and increase of indican in the urine.

Instances of digestive disturbance in obesity, scurvy and rickets need not be treated here. States of indigestion are also common in the subacute and chronic forms of rheumatism, in arthritis deformans, Addison's disease, and angioneurotic edema.

DISEASES OF THE UTERUS AND ADNEXA.

Reflex disturbances of the stomach are common in disease of the female internal generative organs and appendages. That the association between the two organs is intimate is seen in the nausea, loss of appetite and bad breath during menstruation, the vomiting and craving for certain special foods during pregnancy, the gastric disturbances accompanying menopause, and the common association of gastro-intestinal conditions with pelvic organ disease. During menstruation it is common to observe subacidity or anacidity, the normal secretion establishing itself after the first day or so. For this reason test-meals should not be extracted during this period. Kehrer has shown that in the first six months of pregnancy the gastric secretions are lessened, the condition sometimes continuing to labor, although the motility is generally normal. Following the loss of blood during labor, the digestive capacity usually is diminished for a few days. About one-half of the women at the climacteric have a gastric subacidity of a continued nature. Dysmenorrhea, retroversion of the uterus, cervix stenosis, chronic pelvic inflammation, menopause with atrophia uteri, salpingitis, parametritis, endometritis, endocervicitis, myoma uteri, and procidentia uteri may be combined with gastric symptoms. The following conditions and symptoms may be present: gastritis, neuroses of the sensory or secretory types, gastroptosis, nephroptosis, coloptosis, mucous colitis, post-meal distress, pyrosis, eructations, nausea and occasional periods of vomiting, distress or pain on pressure over the

epigastrium or other parts of the abdomen, mucous stools and constipation. Most of these, however, are due to primary conditions in the digestive canal, and only influenced toward relief to the extent that operation or cure of the pelvic condition might improve the general state of body and nutrition of the neurological system. However, clinical experience will prove, in women who have marked gastro-intestinal symptoms and pelvic disease or disorder, that in more than two-thirds of them the gastro-intestinal symptoms are due to *bona fide* conditions affecting the alimentary canal, which are separate and apart from the pelvic condition.

DISEASES OF THE SKIN.

Urticaria and Erythema.—As is well known, these conditions are commonly due to absorption into the body of poisonous substances ingested with the food (lobsters, crabs, fish, tainted ice-cream, strawberries, can goods). In cases of urticaria, even the recurrent type, it will commonly be found that a marked hyperchlorhydria exists while the skin eruption is present.

Eczema.—As Hyde has suggested, cases of eczema are often accompanied or produced by morbid affections of the digestive organs. To these, of course, the constitutional states, such as gout, chronic rheumatic states, diabetes, anemia, etc., are added. The association between eczema and abnormal conditions of digestion has not been established, but that such a possibility of cause and effect exists is strongly borne out by results in the treatment of many of the dermatological affections. Before the eruption appears in herpes zoster and when the lower spinal nerves on the left side are involved, the cases may be mistaken for some of the various painful types of acute gastric disturbance; the same is true of right-sided "shingles" with regards to acute conditions of the liver and gall passages.

DISEASES OF THE NERVOUS SYSTEM.

Epilepsy.—Gastric hypersthenia, gastroptosis, gastric atony, and states of habitual constipation or fermentation are common associations with epilepsy. Cases are seen in which a violent gastric crisis occurs parallel to the epileptic seizure, the attacks occurring about two hours after a meal. In these, pain and intense nausea or vomiting may be present. An aura may be abdominal in location.

Chorea.—States of fermentation and putrefaction of the stomach contents have been described in a case of chorea by Ewald and Witte

in which they obtained from the stomach 250 cubic centimeters of a yellowish-brown, fetid, almost fecal-like stomach contents, and in which acetone was noted in the urine. The one case, which at operation proved to be one of pyloric stenosis due as the result of ulcer, was relieved of the choreiform movements as well as the purely gastric phenomena by treatment directed to the condition of the stomach. States of tetany are much more common than choreiform seizures in the above-described stomach condition.

Brain Tumors.—Projectile, "purposeless," vomiting is met with in about 50 per cent. of the cases of tubercular, gliomatous, syphilitic, sarcomatous, cancerous, or cystic tumors of the brain. The bowels are usually constipated in these cases, and blindness and convulsive seizures exist.

Locomotor Ataxia.—Visceral crises, characterized by sudden attacks of paroxysmal pain in the gastric, laryngeal, renal, cardiac, rectal and genital regions are often met with in this disease. Of these, gastric crises are by far the most common and may also be accompanied with vomiting and even hematemesis. It has been reported that hyperacidity of the stomach is the most common condition of secretion in tabes dorsalis. In the 9 cases in which I have made test-meal analysis (8 men, 1 woman), a normal secretion was found in 5, subacidity in 3, and hyperacidity in 1. Gastric hyperesthesia is decidedly more regularly seen, and, after the condition had been established for years and the bladder and rectum symptoms are present, atonic conditions of the hollow viscera of the abdomen are not uncommon.

Neurasthenia.—There is no condition or disease of the neurological system that is more commonly accompanied by gastro-intestinal symptoms than neurasthenia. The mental, spinal, vasomotor states present in these cases, and the sensitiveness of the upper splanchnic area to constitutional conditions, make possible a great liability of gastro-intestinal symptoms in neurasthenia. Hardly a case of general neurasthenia is seen in which disturbances pertaining to the stomach or digestion of foods are not also present. Among such may be mentioned: distress coming on acutely after meals; weight, fullness, burning, pricking, hot and cold and squeezing sensations in the gullet, fauces, tongue and lips; those of hyperacidity, pyrosis and flatulency after meals, tympanitis, and constipation. Among the pathological conditions in the abdomen that may also be present are: prolapse of the various organs, hyperchlorhydria and gastrosuccorrhea, chronic gastric or enteric catarrh, myasthenia, atony or dilatation of the stomach or colon, and hyperesthesia gastrica, gas-

tralgia and enteralgia. Quite obviously, as the abdominal symptoms of neurasthenia predominate over the corporeal, the abdominal type of neurasthenia should be thought of first, and the cerebral, vasomotor, spinal, and urinary symptoms be looked upon as resulting or referred from the abdomen. On the other hand, should the symptoms be mostly corporeal and but little or not at all abdominal, general nervous weakness should be thought of. Naturally, when the abdominal conditions mentioned are present, attention directed to them should always be given in the treatment of the case; particularly is this important in the abdominal types of the disorder.

Hysteria.—This functional disorder is commonly accompanied by symptoms referred to the digestive tract. Among these may be mentioned globus hystericus, dysphagia, hysterical vomiting, regurgitation of food without nausea or true vomiting and possibly persisting for months, aversion to and obstinacy in the taking of foods, depraved appetite, sensory gastric disturbance, flatulency, constipation, diarrhea, hiccoughing and peristaltic unrest of the stomach and reversed peristalsis of the intestine. The character and persistency of these and the other symptoms to all forms of treatment usually make diagnosis easy.

CHAPTER XXVIII.

Functional Disturbances of the Stomach.

DISTURBANCES OF SECRETION.

HYPERACIDITY AND HYPERSECRETION.

Classification of States of Excess Gastric Juice Secretion.

HYPERSECRETION of gastric juice, represented both in the conditions designated as hyperchlorhydria or gastrosuccorrhea, is a symptom of some form of irritative stomach disorder. It should be looked upon as a symptom to as much an extent as edema is recognized as a symptom of renal, cardiac, or blood disease, or a cough or expectoration are of disease of the respiratory tract. The sooner this is generally observed the better it will be for a fuller practical understanding of what are the commonest of all demonstrable gastric conditions. In this volume a functional distinction is made in the types of excess secretions that may exist; the term hyperchlorhydria representing a too high secretion of gastric juice occurring only during gastric digestion, the stomach being alkaline or neutral in the interval, and the term gastrosuccorrhea representing a more continuously high secretion during gastric digestion and persisting to a less extent when the organ is empty of food. The latter form is divided into two arbitrary forms, namely, gastrosuccorrhea periodica designating that form in which the total clinical course of the condition is short, and gastrosuccorrhea chronica referring to the form in which the condition is continued over a length of time. In clinical work it is not possible to divide the different degrees of hyperacidity or hypersecretion in a definite way, and assign all cases as positively belonging to one of the three types. Assuming all causes of increased secretion as that of irritation, insensible clinical gradation from one state into another is seen. That is, first there is hyperchlorhydria, then gastrosuccorrhea periodica and finally gastrosuccorrhea chronica. These cannot be considered as separate diseases or distinct clinical conditions, but rather degrees of hypersecretion which in depth are according to the

ETIOLOGY AND PATHOLOGY

Hyperchlorhydria, or hyperacidity of the stom: quent of all gastric disturbances, seen in about one conditions. The affection is observed in the youn and not so frequently in the old. It is said to be fou among the better and wealthier classes than among can consider dispensary patients as sufficiently have my doubts. Of 560 patients in private prac digestive disturbance the diagnosis of hyperchlorh 171 (30 per cent.), and of 170 in dispensary work made in 298 (42 per cent.). The fact, as Jaworsl that the condition occurs with great frequency amo may account for the comparative highness of Although, in my opinion, the factor of neurosis between the two sets of patients, that of improper o decidedly more prominent in the clinic patients. races the commonest gastric neuroses are those of s anatomical lesions are demonstrable in cases of si The following factors are important in its producti

1. Disturbances in the secretory apparatus of t mental states. These are noted in cases of mental s work, anxiety, worry, hysteria, neurasthenia, melan psychic conditions. From the works of Pawlow[1] have learned of the intimate relationship that there of the mind and secretion and motility of the gast these and clinical observations it is logical to infer sudden mental shock may bring on states of low c or motility, and when these are continued over a leng strain) the very opposite may occur in the secretic the same time remaining normal or even being dep

2. Indiscretions in diet, such as the use of irr foods, the continuous taking of too large meals, the coffee and tea and particularly that of tobacco, hast of too hot or too cold fluids or carbonated beverages the meals, foods that are too highly seasoned wi heavy users of garlic, shives or onions, and those wh or are frequenters of the soda-water counter.

3. Primary myasthenic or atonic states of the s as causes. As to whether these should be conside factors of hyperacidity I have my doubts. The s secretion in the cases of primary types of atony fr

tainly does not definitely warrant this association. I believe that the connection is more apt to be the reverse—that is, first a long-standing hyperacidity and then the resulting atony. Normal and low gastric secretions are very common with atony and the former are not always transcending states from hyperacidity as might be caused by a chronic gastritis. The same holds true in so far as constipation from intestinal or gastro-intestinal atrophy is concerned. This form of constipation is chronic, and in the cases states of high gastric secretion are by no means steady features. It is more regularly seen in acute constipation which most often is accompanied with gastric hyperacidity for the time being, and the chronic forms with a normal status of secretion. In other cases again constipation should be looked upon as a result of the hyperacidity rather than the primary cause.

4. Symptomatic hyperacidity due to open, more or less healed, or irritative scars from acute or chronic ulcer, early stage of gastric carcinoma and possibly all through malignant degeneration of an ulcer where the cancer formation is mostly extragastric, cholelithiasis, pancreatic and renal calculi, acute hepatitis, chronic appendicitis, mild degrees of acute gastritis, gastritis acida and chlorosis.

Gastrosuccorrhea, or hypersecretion of gastric juice, is described in three forms, namely, digestive gastrosuccorrhea, gastrosuccorrhea continua periodica, and gastrosuccorrhea continua chronica. The etiology of these are decidedly more times pathological than neurotic. It may be said that the proportion of pathological cases increase as we pass from the digestive hyperacidity through the form of periodical hypersecretion to the chronic continued forms.

Digestive or alimentary gastrosuccorrhea was first described by Strauss, who has since then devoted much study to the subject. This author draws distinct attention in this condition to the presence in the stomach of an unusually large proportion of fluids to the solid contents, and warns against mistaking states of motor insufficiency for it. Boas, Elsner and others have more or less confirmed his observations. The condition occurs more frequently in males, and usually in young and middle-aged persons. According to Strauss, the disturbance is probably mainly due to abnormal irritability of the secretory apparatus. It may be looked upon clinically as a more pronounced hyperchlorhydria and a sort of intermediate condition between true hyperchlorhydria on one hand and states of distinct gastrosuccorrhea on the other. The same etiological factors mentioned under hyperchlorhydria enter into the production of this disorder.

Gastrosuccorrhea continua periodica comprises the next step in the pathogenesis of these conditions. In this, as in gastrosuccorrhea

continua chronica, a more or less continuous flow of gastric juice exists even without the stimulus of the ingesta, excepting that in the first the condition lasts for from three days to two weeks and comes on in attacks, whereas in the second the flow of gastric juice continues over lengths of time. It is about at this phase in the clinico-symptomatologic aspect of these conditions that the dietetic and neurological factors which enter into the production of excess secretion give way in prominence to truly pathological disease. Still, that the mental and dietetic factors that were mentioned under hyperchlorhydria must also be continued as sufficient factors seems to be proven by a number of prominent observers, but certainly not to the extent or in the number of cases that they are in the more simple conditions. It may be about at this point in the development of these conditions that some serious disturbance with the harmones or a long-standing irritative or dietetic condition, causing possibly an increase in the number of parenchyma cells of the gastric glandularis, comes in for consideration. A number of these cases have been presented in the literature and the presentation and argument of their etiology leave much to be desired in the way of clearness. Strauss lays special stress, in the production of the periodic and chronic forms of gastrosuccorrhea, upon retention and irritation of foods (such as may be noted in pyloric spasm and gastroptosis) as an exciting cause. However, since the advent of abdominal surgery, there is no doubt that even with the periodic form possibly a third of the cases have as causative factors those mentioned in divisions 3 and 4 under hyperchlorhydria.

Gastrosuccorrhea continua chronica, or Reichmann's disease, must be considered as the highest development of excess gastric juice secretions. In this type the simple factors (mental, dietetic, etc.) give way to distinct and pathological conditions, prominent among which are states of gastric ulcer; gall, pancreatic or kidney stones, and chronic appendicitis. Added to these are the instances of pathological conditions in the gastric mucosa, mentioned by Hemmeter[3] and Strauss,[4] in which a proliferation of all of the glandular elements of the stomach occurs and particularly the oxyntic or border cells. Of such instances I have obtained specimens from 2 cases, and these conditions must still be considered as non-surgical in character.

Strauss, in an argument against motor insufficiency or simple retention of secretion being insufficient for the development of hypersecretion, draws attention to the fact that hypersecretion can exist without motor disturbance, and in those in which motor insufficiency existed after the disturbance in motility had been removed, the symptoms of hypersecretion persisted for days and weeks before it

disappeared. Also, that under rectal nutrition—therefore when local stimulus from the stomach contents was entirely absent—the amount of secretion obtained from the empty stomach was just as profuse as during the time when food was introduced by mouth. For these reasons he considers the nature of continuous hypersecretion to be a persistent irritability of the secreting parenchyma of the stomach, which of itself may be due to a number of causes. This author concludes that from what has been learned from Pawlow's investigations it hardly appears remarkable that hypersecretion may be of neurogenic origin. Future days will most probably show that the great majority of cases of chronic hypersecretion have a distinct pathological basis,

Fig. 107.—Drawing of a microscopic view of a piece of mucous membrane, removed by stomach-tube, from a case of hyperchlorhydria chronica. The specimen shows particularly the increase of the cellular elements and hypertrophy of the glandular tissue. × 400.

either in the stomach itself or elsewhere in one of the various internal organs particularly those in the abdomen, and it is further my belief that the causes which will remain reasonable for lesser states of increased gastric juice secretions will have a very small place in the majority of cases of gastrosuccorrhea of a continuous nature. Soupault, who operated upon 28 cases of typical gastrosuccorrhea, in each instance found an ulcer at the pylorus. Ewald also believes that cases of gastrosuccorrhea, formerly relegated as a true neurosis, are still always to be regarded as consequences of an ulcer running a latent

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course. Of the 11 cases of undoubted chronic gastrosuccorrhea I have had operated upon because they did not respond to medical treatment, more or less states of healed pyloric ulcers were noted in 5, an apparently normal stomach, but the presence of gall-stones in 4, omental adhesions of a firm nature in 1, and a marked coloptosis requiring resection in the last. One of the ulcer cases in which a pylorectomy had been done died as a result of the operation, in every one of the other 10, permanent relief of the gastric symptoms took place. Of these, 7 were examined after the sixth month following operation (4 gastric ulcer, 2 gall-stones and the coloptosis case). All but one of the first showed complete recovery from the hypersecretion on several test-meal observations; the one mentioned that did not, nevertheless, had no subjective symptoms of digestive distress, but showed a moderate hyperchlorhydria during active digestion but a neutral stomach three hours after a test-breakfast. It is important to add that hypersecretion is chiefly a disease of middle life and is more frequent in countries in which ulcer and hyperacidity are commoner than in other regions. As has been pointed out several times, a gas result of 2 per cent. or over from the fermentation of the neutralized test-meal is of much clinical value in distinguishing the surgical cases.

SYMPTOMS.

Subjective.—In the main, the symptoms of all of these affections are alike, a few points of the practical difference being noted in the higher types as compared to hyperchlorhydria. As a rule the subjective symptoms appear gradually and consist of eructations of acid gas or regurgitation of acid fluid or food, heartburn, pain and burning in the stomach or cardiac region, severe stomach pressure or pains coming on one or more hours after meals and relieved by the ingestion of albuminous foods, such as milk, meats and eggs, and the taking of alkalies or water, or made worse on starchy diets, attacks of vomiting of the stomach contents during the height of gastric digestion, the return burning the throat and benumbing the teeth as it passes over; thirst or excessive flow of saliva, nausea, constipation, anorexia, malaise, headache, loss of weight and strength, and finally the development of general neurasthenic symptoms.

In the taking of the history several most important points should be noted. If the history is a very short one in the duration of illness, or if the stomach distress comes on at the time that the foods are saturated with acid (one or two hours after eating a simple meal) and are less or absent when the stomach is empty, the diagnosis of hyperchlorhydria is suggested. If the patient gives a history of having

recurring attacks over a length of time and intervals of entire relief in the interval, the diagnosis of a digestive or chronic periodic gastrosuccorrhea of the primary or secondary form is suggested. If the history of gastric distress is continuous over lengths of time, and the symptoms of distress are present when the stomach should be empty of foods, such as during the night or early morning, the diagnosis of gastrosuccorrhea chronica is suggested.

Objective.—The diagnoses are made by the analyses of test-meals and the noting of the chemistry of the stomach in the interval. The physical examination of the patient is often negative, although it is usual that in cases of slight disturbances of secretion the individual looks to be in a good state of general health, although may be a trifle anemic; whereas those who have hypersecretion of the marked forms, more or less loss of weight and more marked anemia are noticeable. Examination of the abdomen may display a tenderness or sensitiveness on pressure in the epigastrium or over the stomach, and the manifestations of an atonic or slightly prolapsed organ. A diminution in the chlorides and an increase in indican are frequently observed in the urine. The test-meal and stomach analyses of the various types show the following:—

Hyperchlorhydria.—A poorly digested Ewald meal, a little larger in quantity than normal (total bulk up to 120 cubic centimeters and filtrate never above 100 cubic centimeters); a relatively high acidity for the quantity returned, the unit in a certain amount usually being about or over 30° of free hydrochloric acid, and 30° of combined hydrochloric acid (the main feature is the amount of free hydrochloric acid above the saturation of food, for a normal stomach should not give an excess acidity above 30° in not more than 50 cubic centimeter filtrate), a poor digestion of the starch content of the test-meal, a practically empty stomach two hours after a mixed meal, and an alkaline or neutral stomach after this until food is again taken.

Digestive Gastrosuccorrhea.—The same as above, excepting that the total quantity of return and acidity is higher, the filtrate running to 100 cubic centimeters or above, and, while there is no food in the stomach after meals as above stated, a moderate amount of fluid contents of an acid nature may be obtained in the interval persisting for hours. The morning empty stomach in these cases should be neutral or have only the slightest acidity, and during the attacks the mucous content may then be high.

Periodic and Chronic Gastrosuccorrhea.—A large test-meal return of the same food character as above two (excepting more fluid than either), running as high as a 200 cubic centimeter return and giving

over 100 cubic centimeters of filtrate with a relativel stomach after the second hour of a simple test-mea after the mixed meal still returning a fluid in acid or higher than would be test-meals extracted from in the height of digestion, a continuation of gast independent of the ingestion of foods (usually a straw-colored return), and a persistently acid morni food has been taken.

PROGNOSIS.

In all cases of acute hyperchlorhydria the prog the long-standing types the prognosis is favorable, becoming well on persistent dietetic treatment. Th are the protracted cases and make up a proportion ir condition is symptomatic of a pathological condit where in the body (usually within the confines o pelvis). Riegel, Kaufmann and Steels believe that permanently reduce the secretion of acid. Concern state that if care is taken in these diagnoses and o cases of hyperchlorhydria are dealt with, the secreti in by far the largest proportion of cases providing tl long enough under observation and stringently obser status of gastric secretion when due to dietetic or more positively be worked down than can the low se up in many of the non-pathological cases (of cours acutely suppressed secretions from emotional or psy such instances of hyperacidity as I have kept close r the cases were relieved not only in a sensory way in so far as the running order of secretion was conce ence has been that the majority of the individuals c tion to the condition when a degree of relief from tl toms is obtained, the latter of which is possible in cases. In digestive gastrosuccorrhea the results fr almost as good, there being only a slighly larger pr able cases. In the periodic form of chronic gas results in the way of cure are not so good as both o a primary cause which is removable is discovered. however, in increasing the intervals between the att ing the symptoms when they are on as well as ke comfortable in the mean time. Continuous chronic g not curable by medical means in the largest propor gery giving a much larger percentage of cures. primary atony exists and can be benefited, the prog

tial relief is not so unfavorable, although even here relapses are common. Pyloroplasty and gastro-enterostomy offer the best results in secondary atony, and to these must be added the operations upon other organs in the abdomen, such as those for gall-bladder, renal and pancreatic stones, appendicitis, and anatomical obstructive conditions in the colon. At least one-half of the cases require surgery for cure, medical measures only being capable of relief for the time being.

TREATMENT.

Dietetic.—In the treatment of hyperacidity and the alimentary form of hypersecretion, diet occupies the first and all-important place. The treatment of the periodic and chronic forms of hypersecretion, primarily, is that of the treatment of the underlying cause and in these the diet occupies only a secondary importance. The all-important plan of the diet is that the foods, in character, form or quantity, should produce as little irritation to the mucosa of the stomach as possible. The main reasons for this are that the hyperesthesia of the stomach must be controlled as much as possible, and foods sufficient to maintain equilibrium and if necessary cause an addition in nutrition be employed. The factor of combining the free acidity is really of secondary importance, only of value in the way of causing relief for the time being, and is an unwise plan of treatment to put in practice for all cases. The reason for the latter is that the stomach of hyperacidity is most sensitive in response to all stimulation, and the dietetic one of persistently maintained high proteid foods is liable to perpetuate the condition (adaptation juice of Pawlow) unless the condition is secondary to some devitalized state of the general body or functional disturbance in the general neurological system. Still, on the other hand, these foods in the fluid form and simple character are the best to use for a time in the beginning of treatment, because in that way the element of hyperesthesia is minimized, the subjective symptoms are controlled, most of them are naturally in fluid or semifluid forms (thus handy), and are of high caloric values in small bulks. But, at the point at which the subjective symptoms are controlled, the proteid elements should gradually be withdrawn, the ultimate object being that the diet after that should be mainly carbohydrate in nature. This latter type of diet must be continued over a length of time and test-meal analyses are called for to note that the acidity does not run down too far, or to arrive at the point at which the lowest continuous level that may be possible be noted. Should it be found that the acidity becomes too low, such foods as the animal proteids can be gradually added until normal secretion is stimulated. But if it is

noted that the acidity is normal or still rather high, the vegetable and fish-food diet must be continued indefinitely. The dietetic treatment in cases of persistent hyperacidity should continue for from three months to a year, the length of time in the average case being three months. In alimentary hypersecretion the treatment should be continued longer and the number of cases that eventually are given the meat proteids much fewer. The plan of diet that I ordinarily persist with up to a month in the beginning of treatment is the following:—

This diet is a temporary one and is to be continued until a change is made. The plan of the diet is not to partake of any solid foods whatsoever, and to take the foods that are suggested at regular intervals of three or four hours during the day, attention being paid that a strict regularity is preserved and that the foods are divided up in character and amounts rather evenly for each time. A glass of plain fresh milk and perhaps a few crackers should be taken before retiring, and if there is distress in the stomach an extra glass of milk during the night. The diet consists essentially of only four foods, namely, eggs, fresh milk and cream, well-cooked cereals and bread or crackers, and nothing else in the food or fluid line (excepting plain water) should be taken. The eggs may be eaten raw or cooked in any form, or may be taken in the milk. The milk may be warmed if desirable, but should not be taken too hot or too cold. The "ten minute" modern breakfast foods should not be employed, and the old-fashioned forms of well-cooked oatmeal, ground corn, farina, rice, tapioca or sago are best. To these a little sugar, but as little salt as possible, may be added. The bread should not be too fresh (one day old), any of the sweetened or unsweetened crackers may be used, and also all forms of simple cake providing there are no nuts, raisins, currants, seeds, or preserved fruits in them. The total amount of food in one day should be, four eggs; one quart (4 tumblerfuls) of milk; one-quarter of a pound of fresh unsalted butter, or one-eighth of a pound of butter and an extra quart of milk; one-quarter pound of cereals; two rolls; four medium thick slices of white bread; one-quarter pound of baker's cake or crackers; and one-half pint of fresh cream.

In food values the above diet comprises the following and can easily be raised or lowered to meet the clinical indications or those of weight and work:—

Foods.	Approximate Calories.
4 eggs	290
1 quart of milk	650
¼ pound of butter	1116
¼ pound of cereals	425
2 rolls	175
4 medium thick slices of bread	175
¼ pound of bakers' cake or crackers	450
½ pint of cream	450
Total calories	3731

The diet outlined above also meets the indication for atony in some of the cases, and answers to control the subjective distress in those of hypersecretion. It will be observed that the symptom of constipation commonly present in these cases is not given attention to in the dietetic way. Some authors recommend that in constipation the coarse foods be given, Cohnheim[5] suggesting that in hyperchlorhydria following habitual constipation coarse foods should be used. In my opinion, in no instance of hyperacidity or hypersecretion should the early diet be solid or have any coarse foods. It is best to keep the diet bland in all cases and employ other means (like Carlsbad salts or enema) for the purpose. A stomach that is liable to run acid from any secondary cause is always sensitive to the cellulose-bearing coarse vegetable or solid proteid foods, the only difference being that with the first mechanical irritation is the cause and with the second it is chemical or physiological in nature.

After a month or longer, the diet can be changed, four meals a day being allowed, but milk, cream, eggs, crackers, bread, cereals and butter should always be given the preference. Later on the carbohydrate and hydrocarbon elements should be increased and the more heavy bearing proteids (eggs) and the total quantity of milk lowered. The foods which then answer to the best purpose are mashed potatoes, spinach, pease, beans, lentils, carrots, strained or eaten in purées; more sugar, cake and dextrinized foods, olive-oil; possibly brains, tripe or chicken; vermicelli, toasted corn bread, pulled bread, zwieback, baked or stewed apples (no rind); stewed peaches, pears, apricots or prunes (no rind); buttermilk, malted milk, milk with lime-water or Vichy, milk flavored with tea or coffee, kefir, koumiss, junket, whey, cocoa, albuminous water, and the use of the beverages, Vichy, Congress Hathorne, or Carlsbad. In very successful cases when the acidity has been controlled or if anemia or subnutrition from the dieting develops, the very cautious use of the following may be made: Beef, boiled or broiled; raw scraped beef, roast mutton or broiled chops, roast lamb; boiled, broiled or roasted chicken, turkey or game, and the accessory meat foods, such as tripe, heart, spleen, sweetbreads, etc. Should these be given, it is better not to discharge the case from observation for the time being, because my experience has been that the freedom in food selection permitted often encourages dietetic indiscretions and a return of the condition. In the large majority of cases it is best to eliminate the meat foods entirely for long periods of time; this is certainly true in the long-standing cases of hyperacidity, hyperesthesia, and the higher forms of increased secretion (gastrosuccorrhea).

General Treatment.—General hygienic, physical and hydropathic measures should never be neglected in the treatment. Those who are fatigued from overwork should be ordered to rest, and those who have been under a mental strain should be ordered away to the country, seashore or mountains (it makes no difference which). Outdoor life and physical exercise are most wonderful attributes to the treatment. Those who cannot go away should be made to walk the equivalent of seven miles a day. Walking to the place of business and home again with an additional walk in the evenings often makes this possible without much inconvenience. With the women, less carriage and street-car riding, fewer social functions and theaters, and more exercise and open-air life are important factors in the treatment.

In simple hyperacidity gastric lavage is malpractice. It stimulates the stomach to higher secretion (even when alkaline solutions are used) and thus does harm. In gastrosuccorrhea, on the other hand, considerable subjective benefit can come from the use of gastric lavage, but the analyses of many cases have proven to me that this is not due to a lessened acidity but to a raising of the mucus content which is generally short in these cases. I have yet to see the case of gastrosuccorrhea, in which stomach washing was practised, benefit in a lowering of the acid content. In these, lavage four or more hours after a meal, late evenings, or the first thing in the morning, with a 1 : 1000 silver nitrate solution is often helpful but not curative.

In patients susceptible to the use of electricity the employment of any form would be helpful for a short time. In a proportion of others intragastric galvanism with the positive pole internally and if results are not obtained the negative pole internally is helpful. In persistent hyperacidity, and alimentary and chronic periodic gastrosuccorrhea, the internal negative pole with rather a strong galvanic current occasionally gives signal results. When atony or marked constipation exists, the faradic current with slow interruptions or the sinusoidal current is the best to employ. In neurasthenia, high frequency to the spine often serves to good purpose. Of late, because of the success met with in the treatment of ulcer cases, I have employed the therapeutic use of the X-rays in cases of persistent hyperacidity and hypersecretion and have had some striking results from it (due, I believe, to an atrophying effect of the rays on the cells in the gastric tubules, which are proliferated in many of these cases).

The morning cold spray or plunge bath, or the morning rub with a cold, wet towel are serviceable adjuvants. Warm poultices or Priessnitz bandages are frequently useful for the relief of pain, and a spinal

hot douche before retiring may be a most grateful procedure in cases of insomnia.

Medicinal Treatment.—Alkalies for a long time have properly played an important rôle in the symptomatic treatment of these affections. In all of the forms mentioned, positive and almost immediate benefit comes from their use, and no harm develops from their continued employment over long periods of time. As a rule, they should be administered after the taking of foods, the time gauged according to the time that subjective symptoms develop, which is generally at the height of digestion (from one to three hours after meals). The forms of prescriptions that are to be recommended are the following:—

For hyperchlorhydria:—

℞ Magnesii usta,
Bismuthi subcarbonatis,
Sodii bicarbonatis,
Sodii carbonatis exsic.,
Sacchari lactis .....āā 10.0 ʒiiss

Fiat pulv. Sig.: Take one-half a teaspoonful in water one, two, or three hours after meals.

Or,

℞ Magnesii usta ..... 10.0 ʒiiss
Bismuthi subnitratis ..... 20.0 ʒv
Syrupi acaciæ ..... q. s.
Aquæ destillata .....q. s. 200.0 ℥viij

Fiat et Sig.: Take one tablespoonful (as required in time) after meals, plain or in water.

When constipation exists:—

℞ Magnesii usta ..... 10.0 ʒiiss
Mistura rhei et sodæ ..... 200.0 ℥vij

Fiat et Sig.: Take a tablespoonful (as required in time) after meals in water.

Or when a powder or mixture is not desired:—

℞ Magnesii usta,
Bismuthi subcarbonatis,
Pulv. rhei .....āā 25.0 ʒvj

Fiat tablets no. L.
Sig.: Take one or two tablets (as required in time) after meals.

The second drug of importance and which is particularly of value in hypersecretion is belladonna or atropine. This drug effectually inhibits excess secretion, but unfortunately a non-physiological stage may be acquired, or its unpleasant physiological effects that are about may be such that its employment would have to be discontinued. The hypodermic administration of atropine has been sug-

gested by Riegel, but its use by mouth is sufficient for all practical purposes. The tablets or pills of extract of belladonna, 0.016 (¼ grain), or atropine sulphate, 0.00065 (1/100 grain), may be given after meals, or these may be added to any of the foregoing alkaline combinations, or given in the following:—

℞ Ext. belladonnæ ..... 0.32 gr. v
Bismuthi subcarbonatis ..... 15.0 ʒiv
Fiat tablets or powders no. xx.
Sig.: Take one before meals. (And possibly one of the antacid mixtures mentioned above after.)

The bismuth salts, calcined magnesia and cerium oxalate have a mechanical sedative effect on the mucosa. Bismuth subcarbonate, being a better antacid than the subnitrate, is the most serviceable, and combinations have been mentioned. The following of Stockton is helpful:—

℞ Cerii oxalas ..... 1 part or 10.0
Bismuthi subcarbonatis ..... 2 parts or 20.0
Magnesii carbonatis ..... 4 parts or 40.0
Fiat pulv. et Sig.: Take one-half a teaspoonful every four hours.

Nux vomica in ascending doses has been strongly recommended by Musser in hyperchlorhydria due to a sensory neurosis. This author claims uniformly good results from its use. Other bitter tonics are to be avoided.

Nerve sedatives, like the bromides, valerianates and sumbul, are the most valuable of all drugs to control the symptoms of hyperesthesia. It must be remembered that gastric hyperesthesia is commonly present in these cases, and the symptoms of this are most pronounced when irritation from free hydrochloric acid takes place. A prescription to be recommended is the following:—

℞ Sodium bromidum,
Tinctura valeriana,
Ext. sumbul fl. .....āā 15.0 ʒiv
Syr. simplex .....q. s. 90.0 ℥iij
Fiat et Sig.: Take a teaspoonful after meals in water.

Olive-oil and other forms of hydrocarbons have been highly recommended. Cohnheim has written much and always highly advises the use of olive-oil. The plan of this author is to administer 100 or 200 cubic centimeters of olive-oil (through a stomach-tube) each morning, or it may be given in smaller quantities before meals. The oil coats the interior of the stomach and inhibits the secretion of acid. As a general routine of practice in hyperacidity, this treatment is not satisfactory. Many patients object to the use of the tube and others again are nauseated by taking the olive-oil or such quantities of it

before meals. Still, when it is easily taken it may be used, because it is efficient in the desired way, is a good reconstructive to undernourished patients, and may keep the bowels regular. However, no addition of salt to the olive-oil to make it more palatable should be allowed, and it should not be used in cases of fat intolerance or those who complain of headache and eye symptoms after its use. While not so much benefit in controlling acidity comes from the plan of taking fats with the meals, still the heavy indulgence of the more palatable forms (butter, cream, or milk) often serves to good purpose in these cases.

A morning dose of Carlsbad salts in a glass of warm water is an excellent practice in cases of very high acidity or hypersecretion. This salt possesses the double value of neutralizing the acidity present and moving the bowels, and when given well diluted in water it acts as an internal lavage of the stomach. The Carlsbad salts can also be used in small doses at mealtime, the dose being about 1 gramme (15 grains) in Vichy after the meals.

Surgical Treatment.—In all cases of hyperacidity or hypersecretion, the treatment should first be medical and kept up for a definite length of time depending upon the severity and persistency of the case. If after up to six months' time of steady observation test-meal analyses still show a marked hyperacidity or hypersecretion, one of two decisions should be made, namely, the long persistency of medical treatment to afford subjective relief, or surgery. Notable among the ones in which surgery is indicated are: those in which a history of gastric ulcer is obtainable or strongly suggested; those in which a high fermentation of the dextrose content of test-meals suggests these conditions; gall, kidney or pancreatic stones; chronic appendicitis, and those of gastrosuccorrhea continua chronica of a primary nature which do not respond to the use of the X-rays. When it is possible to arrive at a definite pathological diagnosis of any of these conditions early, surgery may be at once indicated. The form of operation depends upon the organ involved, always remembering that the performing of a gastro-enterostomy or pylorectomy is only permissible in the primary stomach affections; it would be foolhardy to perform a drainage operation upon the stomach and leave any of the calcareous conditions in the other organs or a pathological appendix untouched. On the other hand, when other organs than the stomach are operated upon, even should the acidity of the stomach remain high for a time afterward, operation upon the stomach should only be done as a final result. The reason for this is because in cases of secondary hyperacidity and hypersecretion it often takes months before the stomach

secretion becomes normal; this is also true in cases of a primary stomach nature when a gastro-enterostomy had been performed, and particularly is this true if a perigastritis or a long-standing atony existed.

SUBACIDITY AND ANACIDITY.

Classification of States of Low or Absence of Acidity.

In no other condition in medicine is there found such a confusion of designating terms as is met with in connection with these conditions. Efforts at classification and simplification have added new ones to their numbers to such an extent that it now seems desirable to simplify these into the terms subacidity and anacidity, adding to these an etiological connection in those cases in which this is possible, and leaving them plain when it is not. As the subject now stands, some of the terms that are synonymous with subacidity are: hypochlorhydria, hypopepsia, depressed secretory neurosis, subchylia and hypochylia; and those that are used in connection with anacidity are: achylia gastrica, apepsia gastrica, apepsia and anachlorhydria. It will be seen that none of these comprises a comprehensive clinical picture, but, instead, a series of peculiarities common to many gastric and general conditions. What was said in connection with increased gastric secretions in the way of the accumulating course of secretory change also holds true here, excepting, of course, that in the latter states the change is downward. Still more so than with excess secretion, these conditions are of pathological origin both in so far as the stomach is concerned and organic and functional conditions of the general body. Subacidity pertains to the condition in which a low secretion of hydrochloric acid takes place, with or without a lowering of the enzyme content. Anacidity pertains to those in which the hydrochloric acid is absent but the enzymes are present. And achylia has to do with those in which neither are present. As these are more or less progressive states, they will be considered together.

ETIOLOGY AND PATHOLOGY.

It has been shown that under emotions of excitement or depression the secretory as well as the motor functions of the alimentary canal can be markedly affected. In instances of prolonged anxiety, worry or suspense, the secretory functions of the stomach are usually inhibited, may even be entirely absent for the time being, and but very rarely run hyperacid. In the practical handling

of these cases the effects of emotions must be taken into consideration, and too much significance must not be attached to test-meals removed under these conditions; the same is true of those removed on the first day of menstruation. There is, however, a form of subacidity of a neurotic nature in which the hydrochloric acid and possibly also the other constituents of the gastric secretion are lessened in a more continuous way. While some of these may be psychic or mental in causation, most of those that I have seen are due to debilitated states of the general body from long-standing unhygienic conditions, anemia of a mild or moderate type, neurasthenia, hysteria, Graves's disease or tabes dorsalis. Subacidity is a most constant finding in the forms of chronic gastritis in which the mucous membrane is degenerated or partly atrophic, in the early stages of cancer and the febrile conditions. In the purely neurotic cases no pathological lesions are present, not even when anacidity exists. In persons who have passed the fiftieth year of life, a marked tendency to diminution of the stomach secretions takes place. In the aged, as Liefschütz has shown, a complete absence of free hydrochloric acid is not a rare phenomenon. Added to these are also the causes of anacidity and achylia which are described in the following paragraph:—

The cases of achylia may be divided into those who have had the condition all their lives and having had no digestive symptoms are not aware of it; the cases of simple depression of the secretory function due to reflex irritation, neurasthenia, or low states of general nutrition in persons in whom the condition disappears as improvement in general health takes place; pernicious anemia, or long-standing diarrhea in which no pathological lesion of the stomach can be found; and, finally, the second form seen in atrophic gastritis, gastro-enteric atrophy and malignant disease. In by far the largest proportion of cases of achylia, a form of chronic gastritis is present in which there is seen a soft and vulnerable mucous membrane easily bruised with a granular degeneration of the cells and round-cell infiltration (granular gastritis). The next most numerous cases are those in which the characteristic pictures of a well-advanced atrophic gastritis is noted. While it seems to be conclusive that cases of achylia can exist without anatomical lesion in the stomach (achylia nervosa), still the fact that no excess mucus is noted in the test-meals or in the absence of a history of cause, one should not be too hasty in assuming that we are not dealing with a condition of distinct disease in the largest proportion of cases that are seen. Fruitful among the causes that may produce the granular or atrophic forms of gastritis having achylia are: alcoholism; the prolonged administration of certain drugs, such as

salicylicates, mercury, etc.; the intemperate use of tobacco, particularly when it is chewed; continuous circulation of toxins in cases of chronic nephritis and putrefactive conditions of the gut, long-standing anemias and states of subnutrition.

SYMPTOMS.

The symptoms of subacidity, anacidity or nervous achylia vary greatly, and often there are no subjective symptoms at all. Sensations of epigastric pressure, fullness, eructation, anorexia, diarrhea, intestinal disturbance, occasional nausea, headaches, great nervousness are the most common. These patients often show more or less general disturbance in health, and in cases of gastritic achylia a condition of more or less debility, mild invalidism, or susceptibility to disease is common.

Einhorn[6] makes a clinical division of achylia gastrica into three groups: "(1) In individuals having no gastro-intestinal symptoms whatever, and who are in good general health. (2) Patients presenting a greater or less number of gastric symptoms. (3) Patients having apparently no gastric symptoms, but presenting marked intestinal disturbance." (To these may be added the cases in which both gastric and intestinal symptoms are present, and those who have no gastro-intestinal disturbance but present the general symptoms of anemia, devitality, quick exhaustions and lack of disease resistance, making five in all.)

The main symptom for diagnosis is the objective one of test-meal analysis. In subacidity an absence of free hydrochloric acid is often noted or the dimethylamidoazo solution or paper will show only a faint reddish tinge. The analysis usually proves that such of the natural acid as was secreted is in combination with the food elements, the combined hydrochloric acid being from 1 to 30 degrees and the total acidity about 10 more. In anacidity no hydrochloric acid results are noted, but a few degrees of total acidity with more or less of the pro-enzyme are present. The latter should always be examined for so as to separate the cases of anacidity from true achylia; this is important from both a diagnostic and prognostic standpoint. In achylia no free or combined hydrochloric or enzyme is present, but a few degrees of total acidity may be noted. Other test-meals, however, are absolutely neutral or even alkaline in reaction. In cases of achylia in which general symptoms of reduction of health are present, a high albumin loss of food in the feces is usually noted. No case should be diagnosed as an achylia on negative results in noting acidity on the Töpfer method alone. The Hayem-Winter method of estimation of

the total chlorides and the tests for the enzymotic power of the gastric filtrate should always follow, and, furthermore, the absence of HCl and enzyme must be noted on every occasion of examination of test-meals (and several should be extracted), and the morning stomach should be examined for desquamating tubule cells (atrophic gastritis) before the diagnosis is accurate. By the observance of these rules, the number of cases of "achylia gastrica" will fall to such an extent that the above term will be nowhere near as frequently used as it is to-day. During the menses, a diarrhea, constipation, motor disturbance of the intestine, and high, low or absent secretion in the stomach may occur.

PROGNOSIS.

The prognosis in cases of subacidity and anacidity depends upon the possibility of treatment results of the causative condition, usually, however, it is good. The above, and also the instances of achylia in which no gastro-intestinal or general symptoms are present, generally continue in good health, although those of achylia due to gastritis require watching that the general health is maintained. The prognosis in achylic cases in which symptoms are present depends upon whether the condition is a primary or secondary condition, and what the nature of these may be. Excepting in cases of malignant disease, pernicious anemia, and chronic nephritis, the prognosis for continued life is good. When well in hand, unless the disease is far advanced and complications are present, cases of atrophic gastritis or gastro-enteric atrophy do well on treatment but cannot be cured. The same may be said of those due to granular gastritis and the long-standing diarrheas.

TREATMENT.

Dietetic.—The diet in these conditions forms the most important item of treatment. The main factors to be kept in mind are: to meet with just enough proteins all of the hydrochloric acid that would be secreted in subacidity; to give proteins of such kinds, form and quantity as would be readily digested in the intestine in the cases of anacidity and achylia, and to maintain the highest degree of nutrition in all of the cases so that general strength can be maintained or if possible improved. Important to these ends is the use of foods that are finely divided and the liberal employment of the well-cooked carbohydrates. When there is some acid secretion present the meats may be given, but these should always be in limited quantities and finely divided. In a few of the cases of anacidity and achylia a small amount of meat or the substitute meat foods (brains, boiled sweetbreads) are

well taken care of in the bowel, and in these instances they should be advised. As a rule, however, it is impossible to foretell in which of the cases this will be found, but they comprise mostly the neurotic and congenital cases. High albumin loss with the return of a large amount of the red meat fibers of a striated or unseparated condition in the feces are found mostly in achylia due to pernicious anemia, nephritis and diarrhea. Still, even in these cases, if no special digestive distress from meat is met with, they may be given; but, of course, in very small quantities, frequently repeated, and always finely comminuted. Milk as a rule is not well tolerated, its digestion causing stomach distress and perhaps a diarrhea. Of the liquids, broths, such as rice, chicken, barley, albuminous drinks, and raw or soft-boiled eggs are recommended. The protein-bearing carbohydrates (pease, beans, lentils) in purée form or broths are useful. Potatoes, rice, tapioca, sago and farina well cooked in water or milk are very well borne. Any of the breads, rolls, simple cake or crackers with butter in moderate amounts are well tolerated. Tea, coffee, cocoa, and in milk intolerance, koumiss, kefir, or matzoon may be allowed. In cases of anacidity and achylia the following diet list is of service. As these patients are most difficult to diet in variety of foods so as to prevent monotony, a line of foods is given:—

The plan of diet is to partake only of fluid or semifluid foods, taking these at three or four hour intervals during the day and evening and preserving a regularity in that strict intervals of time are maintained. The vegetables (excepting the rough forms), starches and cereals, all of them cooked as soft as possible and taken in a mashed porridge or fluid form, are wholesome. The quantity taken at a time should be moderate and best spread over ten minutes of time at each feeding. The meals should be begun at 8 A.M. and ended at 10 P.M. Among some of the preparations of food that would serve of value in your case are the following:—

ALBUMINOUS DRINKS.

Egg broth.	Matzoon.
Egg-nog.	Junket.
Junket egg-nog.	Rice milk.
Beef egg-nog.	Mutton broth.
Albuminized water.	Nutritious beef broth.
Albuminized clam-water.	Broth with grains.
Grape yolk.	Egg broth.
Grape juice and egg.	Cocoa.
Malted milk and egg.	Malted milk cocoa.
Koumiss.	

SOUPS (with or without noodles, crackers, or croutons).

Cream of celery soup.	Mock bisque soup.
Celery soup (gum gluten).	Green pea soup.
Corn soup.	Rice soup.
Asparagus soup.	Victoria soup (with broth).
Tomato soup (with broth).	

Cereals.

Flour gruel.
Porridge.
Cracker gruel.
Barley gruel.
Barley gruel with broth.
Arrowroot gruel.
Indian meal gruel.
Rice farina and oatmeal gruel.
Gum gluten breakfast food.
Corn meal mush.
Hominy mush.
Rolled oats.
Steamed rice.
Boiled rice, farina, tapioca and sago.

Fruits.

Pineapple.
Baked banana.
Steamed rhubarb.
Baked apples and apple sauce.
Stewed prunes.

Pastry.

Rolls, any kind.
Bread, any kind.
Cake or crackers, any simple kind.

Shellfish.

Raw oysters (no condiment excepting lemon).
Pan roast oysters.
Broiled oysters.
Oyster stew and oyster soup.
Creamed oysters.
Scalloped oysters.
Clam bouillon bisque.

Eggs (4 a day).

Soft boiled.
Steamed or baked eggs.
Golden rod eggs.
Egg nests.
Plain omelet.
Foamy omelet.
Bread omelet.
Poached eggs plain.

Fish.

Creamed fish.
Baked or boiled fish (plain sauce).

Vegetables.

Boiled potatoes.
Riced potatoes.
Mashed potatoes.
Creamed potatoes.
Baked potatoes.
Pease, Beans, Lentils, in purée form.
Spinach.

Desserts.

Soft custard.
Meringue or floating island.
Banana, peach or apple custard.
Baked custard.
Chocolate.
Malted milk or baked caramel custard.
Fruit whips.
Soufflés.
Junkets (custard, cocoa, coffee, plain).
Cornstarch pudding.
Pineapple cream.
Cornstarch, fruit jelly.
Gum-gluten pudding.
Rice pudding, peaches and rice.
Steamed and boiled rice.
Rice meringue.
Cream of rice pudding.
Chocolate or cocoa blanc mange.
Plain or tapioca cream.
Pineapple, apple or raspberry tapioca.
Bread and cracker puddings.
Gelatin.
Jellies (fruit and cereal).

Because many cases of subacidity, anacidity and achylia are continued conditions, the diet must be kept up over long periods of time and thus it is impracticable to maintain the caloric principle of feeding in a scientific or continued way. Therefore, it is wisest to give a long list of safe foods and preparations like the above, and observe that nutrition is maintained in the practical way, namely, by the constant use of the scales and the appearance and feeling of the individual. In selected cases the meats may be added in small quantities.

General Treatment.—Other than the diet and unless some organic condition of the stomach exists, most of these cases do not require treatment for the stomach alone, but rather for the condition of general body that is causing it, and for this reason the very highest standard of body nutrition in the diet is important. Intragastric faradism may be used when the gastric motility is impaired. In the cases in which a general neurosis is the cause of the low or absent gastric secretion, the physical and hydropathic treatments may, under favorable circumstances, act indirectly in producing a flow of hydrochloric acid. But in the cases of long-standing achylia care must be exercised in advising forms of physical exercises, for the reason, firstly, that these patients are not physically strong and are hard to build up, and, secondly, that they peculiarly constitute a class of patients who are easily and quickly bored unless the form of exercise is entertaining as well (golf, tennis, walking, outdoor work, etc.).

Medical Treatment.—Drug treatment represents on the one hand a substitution therapy, and on the other an attempt to increase the diminished secretion. Pawlow has shown that raw meat, meat juice, meat broths, Liebig's meat extract, gelatin, and certain peptones stimulate the secretion of gastric juice. Small amounts of alcohol have been shown to do likewise, and the occasional use of Byrrh wine or Dubonnet before meals may be used for the purpose. In a few of the cases the gustatory stimulation from the use of the bitter tonics may activate a hydrochloric secretion, but this is by no means common enough to deserve first attention in the treatment. In this, what cannot be accomplished by the use of hydrochloric acid, either in lavage or given diluted by mouth, cannot be accomplished by any drug known to-day. As to which of the cases is going to respond best to the acid plan of treatment, and which best to the alkaline it is usually impossible to foretell in the beginning. In this there is hardly less difference between the subacidities and anacidities and the achylias. Nevertheless, a few practical points have come to me, and they are that the acid treatment is effective in most of the diarrheal and

neurotic cases, and a few of pernicious anemia. Most of the cases of late atrophic gastritis and nephritis, and a few of the neurotic conditions do badly on the acid, and its use must be discontinued because of the stomach distress that is caused. Still, one can never be sure in advance with any one of the types, and since the use of the acid treatment is the most rational one, it is always best to give it a few days' trial, perhaps telling the patient at the time that a little harmless experimentation would be necessary in the beginning of treatment. If it stops the gastric distress, the treatment for that case should be an acid one, and if it intensifies it, the very opposite, namely, an alkaline.

When well borne, from 2 to 6 cubic centimeters (30 to 90 drops) of the dilute hydrochloric acid should be given in a glass of water, one-quarter of the tumbler being taken at quarter-hour intervals after a meal. When it is badly tolerated, the stomach digestion should be rendered alkaline, the stomach as an organ of digestion being practically considered as a part of the intestine, its only function being that of a receptacle for food. In such instances the following harmless prescription serves to good purpose:—

℞ Pancreatin	10.0	ʒiiss
Soda bicarbonate	20.0	ʒv

Fiat pulv. no. xx.
Sig.: Take one after meals in water.

For anorexia there is no better treatment than insisting upon taking sufficient quantities of food, and the use of tincture of nux vomica 1 cubic centimeter (15 drops) well diluted before meals. In anemia a high feeding should be kept up, and in the non-tolerant acid cases the non-astringent forms of iron given, and in the tolerant acid cases the stronger forms of iron, of which the tincture of ferric chloride is the most effective, particularly when kidney complication exists. A good prescription is the following:—

℞ Tincture nucis vomicæ	8.0	ʒij
Tincture ferric chloride	10.0	ʒiiss
Syr. simplex ad	90.0	℥iij

Fiat et Sig.: Take one teaspoonful well diluted in water one-half hour after meals.

Rhubarb or cascara may be used in constipation, and colonic times of help, these to be taken with the meals.
flushings, either per rectum or after appendicostomy, would be preferable in the cases of gastro-enteric atrophy with marked secondary anemia or pernicious anemia. When no atony exists, the use of the sodium chloride waters, Kissengen, Weisbaden, Homburg are some-

HETEROCHYLIA.

This term was devised by Hemmeter[7] to denote an alternating state of secretion occurring chiefly in "nervous dyspepsia." A number of no doubt authentic cases have been reported from several sources, in which at different times within a short period the stomach analyses show a subacidity and hyperacidity; more commonly, however, are those which run from anacidity to hyperacidity. It is most probable that the condition is not of stomach origin, but due to a neurological source in which the innervation of the vagus or sympathetic is mainly affected. Among the symptoms that have been reported are anorexia, and a sense of weight and fullness in the stomach when the acid is low, and pyrosis and eructations when it is high. In 2 cases that I have observed there was no suggestive difference in the types of gastric symptoms between the high and low levels of acid. One was in a highly neurasthenic male of thirty-one, and the other an hysterical woman of forty-seven. Altogether 22 gastric analyses were made in these cases and the run of total hydrochloric acid was between 11 and 79 degrees. When it was low the free acid was absent, but there existed a normal amount of the pro-enzyme; when it was high, both were uniformly increased. The state of secretion seemed to depend much upon the neurological condition present at the time.

The treatment in these cases was mainly hygienic, climatic and high proteid findings, both of them making substantial improvement and obtaining a more steady gastric secretion in the course of time. In this it is well to remember that the treatment should be general in so far as the body nutrition or neurological condition is concerned, the resulting stomach condition being of only very secondary importance.

GASTROMYXORRHEA.

Dauber[8] was the first to point out that under abnormal conditions a flow of mucus can occur from the stomach. In these cases are excepted those in which a small amount of mucus is obtained from the fasting stomach. In fixing the standard of departure from the normal, Kuttner regards the recovery of more than 5 cubic centimeters of mucus from the fasting stomach as pathological, but considers the condition one of gastromyxorrhea when more than 25 cubic centimeters are obtained. The cases of gastromyxorrhea have been divided into those in which the increased mucous flow occurs at intervals (intermittent gastromyxorrhea), and the much more frequent form (continuous gastromyxorrhea). It is probable that many of these

cases are not recognized and that the condition is more common than is supposed. The reasons for this are that extractions from the empty stomach are not common enough routine examinations, and in the chronic form the subjective symptoms of distress are not suggestive and in fact, as I have observed on four occasions, may not be present at all.

Up to this time two etiological connections have been made. Kuttner believes that in the acute forms there is some connection between the affection of the nose and that of the stomach, and in the 2 cases he reported that the attack took its onset with increased discharge from the nasal membrane. In the chronic form the condition may accompany subacidity or anacidity, or the various organic diseases, or may exist as an independent functional neurosis. Kuttner found it most frequently with chronic gastritis, and, in my experience, it is not uncommon to obtain large amounts of mucus from the fasting stomach in the cases of so-called gastritis acida. It has been assumed that the origin of the mucus is mostly from the glands of the pylorus and less so from the epithelium and other mucous glands of the stomach.

The symptoms in the intermittent cases are a short prodroma of headache, nausea, and anorexia, present usually in the mornings for one or two days. This is precipitated into an attack of severe vomiting of an intractable type, the vomited matter consisting of large quantities of tough, slimy mucus, and finally mixed with bile and intestinal juices. As a rule no pain is present and the symptoms of prostration may be marked. Such an attack may last from a few hours to several days, terminating in a quick return to a normal condition of digestion. A case I now have under observation in which a moderate gastroptosis and myasthenia also exist has had these attacks for seven years, in the beginning occurring about four times a year, and recently about every ten days and lasting for from one to three days. The surprising feature of this case is the intense distress and character of general symptoms present during the attacks, at which time the patient is unable to leave the bed, and the quick return to normal appetite and absolutely tolerant stomach at its termination. In this man the test-meal analysis shows a normal percentage of hydrochloric acid and enzyme in the interval, and on one occasion at the onset of the paroxysm I aspirated 37 cubic centimeters of almost pure alkaline mucus from his stomach. The chronic form is usually devoid of subjective symptoms of distress, the diagnosis only being possible by an aspiration of the fasting stomach after that of a test-meal. Quite naturally, if the return of gastric mucus

from the morning stomach is acid in reaction, a diagnosis of true gastromyxorrhea should be made with hesitancy. Care must be taken that the mucus obtained is not the swallowed form from the respiratory tract.

Regarding the treatment of the acute form during a paroxysm a thorough lavage of the stomach with an alkaline solution may terminate the symptoms at once; later on it is useless and too distressing. A hypodermic injection of morphia may be called for as well as external applications of heat to relieve the distress. The best constant treatment, in my opinion, is the use of ascending doses of nux vomica, working these up very gradually until physiological effects are produced, and then continued for some time afterward at a smaller dose. Should the paroxysms be frequent, belladonna in fair-sized doses during the day or 1 rather large-sized dose at bedtime is very helpful. The acute cases that I have seen (only 3) all had had the condition for years, and at the time were in poor general condition, and thus required tonics, climatic and hygienic attentions to improve them. Regarding the continuous cases there is no more efficient treatment than morning and evening lavagings with an alkaline followed by the hydrastic solutions. Nux vomica and belladonna may also be used but effort should be made to diagnose some primary pathological condition if possible, after which the treatment would be according to the disorder found and the general condition of the patient.

REFERENCES.

[1] PAWLOW: "Work of the Digestive Glands," London, 1903.

[2] CANNON: American Journal of Physiology, 1907.

[3] HEMMETER: Archiv f. Verdauungsk., Bd. iv, S. 23; "Diseases of the Stomach," third edition, p. 814.

[4] STRAUSS: Virchow's Archiv, 1898, Bd. cliv.

[5] COHNHEIM: New York Medical Journal, October 12, 1907.

[6] EINHORN: "Diseases of the Stomach," fourth edition, p. 380.

[7] HEMMETER: "Diseases of the Stomach," third edition, p. 866.

[8] DAUBER: Archiv f. Verdauungsk., Bd. xi, S. 167.

CHAPTER XXIX.

Functional Disturbances of the Stomach.

(Continued.)

DISTURBANCES OF SENSATION.

HYPERESTHESIA GASTRICA.

UNDER this term is described the condition in which the glandularis (mucous membrane) of the stomach is hypersensitive to even normal stomach contents. The simplest forms of foods or drink will often cause distress in spite of a normal condition of secretion and motility. In a large number of cases, particularly in the Semitic races, the symptoms of distress are more or less continuous and become immediately intensified on ingestion. Altogether, hyperesthesia gastrica comprises by far the largest proportion of gastric conditions, even among the class of neurotic conditions alone. As a condition it accompanies practically all of the primary stomach disorders and many of the secondary conditions as well. For these reasons it may be looked upon as the simplest form of all gastric disturbances, and, excepting in the purely dietetic cases, may be considered more of a symptom than a clinical entity.

Of the true gastric affections in which hyperesthesia is noted may be mentioned all of the states of abnormal secretions, especially the two extremes of hyperchlorhydria and achylia, and neurasthenia gastrica. My experience has been that the instances of this condition are fewer in the purely neurotic states of subacidity, unless the lowered secretory change is secondary to a state of destructive gastritis. There is no absolute uniformity in this, however, because even in subacidity a marked hypersensitiveness may exist requiring alkalies for its relief, and also that instances of anacidity are seen in which none of these symptoms are present. Furthermore, it has occurred to me that the slower a chronic gastritis is established the surer it is that these symptoms are a feature, and in the more rapid and deeper destructive forms they are commonly less noticeable or pronounced. Confirmation of this may be noted in gastritis secondary to malignant disease, or atrophic gastritis in which it is not unusual to note that the symptoms of hypersensitiveness are absent or may not come on until late. But it can be clinically observed in a number of these latter-

mentioned cases when this sensitiveness to foods is established that it is liable to be most intense, persistent or progressive, and thus intractable to treatment. Of much interest also are the many body conditions or diseases of other organs in which hyperesthesia of the stomach can be looked upon as secondary or referred conditions. Many of these are mentioned in the stomach conditions in disease of other organs described in Chapter XXVII.

Etiology.—As a simple primary affection hyperesthesia is found in long-standing dietetic indiscretions, in neurasthenia and hysteria, in states of anemia, general debility and mental strain, in instances of excessive sexual indulgence, in hyperchlorhydria and anacidity of an acquired type, and in gastric ulcer and chronic gastritis. Among the improprieties of ingestion in which it is found are the occasional excesses in overloading the stomach with foods or drink, results from debauches not severe enough to cause the development of an acute gastritis; the steady abuse of tea, coffee, alcohol, tobacco, highly seasoned foods and opium or cocaine; in subnourished results from insufficient diet, and also from eating irregularly. Post-ulcer hyperesthesia is described in Chapter XX, that of chronic gastritis in Chapter XIX, and splanchnoptosia in Chapter XXVI. It is found more frequently in females, the disproportion being greatest in the younger adult years.

Symptoms and Diagnosis.—The sensation produced is that of mild pain (severe pains are gastralgic), fullness, and weight or pressure coming on immediately upon the ingestion of foods or drink. In the severe cases in which the gastralgic type of pain is not present, a sensitiveness may exist in the stomach causing nausea or even vomiting; the latter, however, is due more to a desire on the part of the individual to unload the stomach than the truly symptomatic kind. Fluids, particularly the very cold, and sweetened or carbonated drinks may cause more distress than solid foods. As a result of the distress the patient fears to partake of sufficient amounts of food, and thus may lose weight and strength and become anemic. The symptoms of hyperchlorhydria, pyrosis, water-brash, and flatulence, coming on late after meals may be present. In my opinion, the one main clinical point in diagnosing this condition is the time after ingestion that the symptoms of distress occurs, which in all cases is immediate and before gastric digestion has begun or advanced to a practical degree of conversion of foods. Test-meals from these cases show a normal secretion with perhaps slight variations, and generally a normal motility of the organ. The diagnosis is made from the dietetic history of the case and the subjective gastric symptoms. In persistent cases all of

the local and general conditions must be excluded before diagnosing primary hyperesthesia. In catarrh and hyperchlorhydria the stomach symptoms usually come on some time after eating. When there is doubt, the facts that the appetite remains good and the secretions and motility normal are helpful to diagnosis. Also, in hyperesthesia, the stomach distress is independent of the character and amounts of food.

Treatment.—According to many authors the treatment should be begun by placing the patient in bed, the institution of a milk or egg albumin diet, and the systemic care of the individual until the symptoms are controlled. While I agree with this for the severe cases, and to an extent with Rosenheim for the chlorotic cases, I can only say as a routine of treatment for all cases, that about one-half of all gastric disorder patients who apply for treatment would make up such an army that very soon there would be no room in any of the largest hospitals to hold them. In practical work, with patients intelligent enough and with purpose enough to follow directions, only the small proportion of cases need to go to bed to get well. The most important feature of the treatment is to recognize and treat any of the causative conditions that exist. When these can be eliminated, and the severe types of the condition are separated out for the bed treatment, the routine of care in the average cases is about the following:—

According to the history obtained, all dietetic causes, matters of abuse, habits, etc. must be stopped. The diet is essentially that described under hyperchlorhydria found detailed on page 730 and this should be prescribed and persisted in until the sensory symptoms are under control. There is a small proportion of cases in which even with the greatest care in the diet the symptoms do not abate not even after lengths of time. In such, the stomach and other organ conditions of a pathological or constitutional nature must persistently be searched for, and if found attention to them must be given as a primary essential of treatment. Should the case still seem to be one of distinct hyperesthesia gastrica, the bed treatment should be given first thought, and if this is not possible, or in the beginning of treatment in all, resort to drugs is generally required. The condition which gives the most degree of confusion is an underlying obscure form of neurasthenia, one in which the general symptoms as well as those in the digestive tract are not distinct. There are other cases again which may have a subacidity of the stomach during gastric digestion and, as paradoxical as it may seem, do best on the alkalies. These cannot be separated out in advance and can only be noted by experimenting for a short time with an acid or an alkaline treatment; these are probably due to a sensitiveness situated in the deep layer of

the glandularis. The high caloric feedings and the routine administration of iron are always in order in the anemic or undernourished patients. The drugs which answer to the best purpose to control distress are the bromides, and it is not unusual to have to employ these in very large-sized doses for a short time and perhaps for one or two months all told. Among the prescriptions for these cases that can be recommended, in addition to the one given in the foregoing chapter on page 734, are:—

℞ Natrii bromidi ..... 10.0 to 25.0 ʒiiss to ʒvj
Aquæ menthæ piperitæ ..... 250.0 ℥viij
Fiat et Sig.: Take a tablespoonful after meals in water.

Or,

℞ Natrii bromidi,
Tinctura valerianatæ .....āā 10.0 ʒiiss
Aquæ chloroformi ..... 100.0 ℥iij
Fiat et Sig.: Take a teaspoonful after meals in water.

Or, when constipation exists:—

℞ Tinctura rhei,
Tinctura valerianatæ .....āā 10.0 ʒiiss
Fiat et Sig.: Take twenty drops after meals in water.

Supplemental treatments that answer to good purpose in many of the cases are: the hygienic and hydropathic measures, cold compresses to the abdomen to relieve the distress, galvanism, occasionally the use of nux vomica in small-sized doses, silver nitrate lavage, belladonna, and a sojourn in the country away from work and other activities.

GASTRALGIA NERVOSA.

Gastralgia is a condition characterized by periodic or spasmodic attacks of more or less severe pain in the stomach, appearing independently of the ingestion of foods, subsiding in a short time, and followed by an interval of complete freedom from symptoms. Gastralgia is about three times as common in women as in men, and altogether comprises about 2 per cent. of the cases of neuroses.

Etiology.—The manifestation of gastralgia may be clinically described as a sensory disturbance affecting the vagus, either directly or indirectly, and locally or generally along the course of the nerve. The most frequent cases are those in which the terminal branches in the stomach are affected. Among the most numerous causes that may bring this condition about are: excessive indulgence in tobacco, irregular and insufficient eating, the steady intemperate use of soda-

water, particularly the kinds that are not flavored with the natural fruit juices, but with artificial chemicals; the habit of drinking iced fluids, and the taking of a large amount of iced drink at some one time, perhaps when overheated or very thirsty, the result of an alcoholic debauch, particularly when much sweetened forms of spirituous drinks (cordials) had been taken; the drinking of much strong tea, coffee or lemonade, and lastly, the forms that may be considered as the deeper developed types of hyperesthesia from dietetic reasons; I have seen gastric cases included under all of the foregoing. To such may be added cases of ulcer or adhesions of the stomach, gallstones and certain forms of acute gastritis, particularly the congestive, inflammatory or hemorrhagic types. Gastralgias of central origin may be noted in the crises of locomotor ataxia, the cerebral tumors and myelitis, and those affecting the course of the nerve may be observed in the anemias, infections, intoxications (lead, gout, opium, cocaine and autointoxications from the intestine), and hysteria and neurasthenia. Of the indirect types may be seen those in which the innervation of the vagus is disturbed by referred stimuli from disease of other organs, and in these are found cases of nephroptosia with Dietl's crises, gastroptosis, enteroptosia, coloptosia, the inflammatory diseases, and circulatory or anatomical defects in the generative system.

Symptoms and Diagnosis.—The attacks of pain, as a rule, appear quite suddenly, although they may be preceded for a few hours or days by premonitory symptoms, such as anorexia, headache or backache, vertigo, fullness or weight in the stomach, slight precordial or stomach pains, and nausea and perhaps vomiting. In the majority of instances the history of these are not obtained unless definite questions are asked, and may even be denied altogether. Within a very few minutes after the onset of the attack the suffering from pain is extreme. This is located in the epigastric and left hypochondriac regions, and is variously described as burning, boring, tearing, cutting or pressing. From the stomach region, the pains may radiate into the left thorax, left shoulder, back or general abdomen, and may be so intense as to cause weakness and collapse (rapid, thready and irregular pulse; pallor, cold extremities, cold sweat, subnormal temperature). The expression at the time is usually anxious and drawn, and frequently the patient is unable to lie down or sit up straight, an attitude being assumed which gives the greatest degree of relief by the relaxation of the abdominal muscles. Among such is a half-sitting position with the knees high and shoulders bent forward, and when lying in bed, on the side in about the same bent position. The abdomen is mostly sunken and the gastric region tympanitic (the

latter is best noted by comparing the percussion note over the lower ribs, seventh to tenth, on both sides). There may be a tenderness on slight pressure over the stomach, and a sense of relief on steady deep pressure. At times these symptoms are accompanied by nausea, vomiting, nervous chills or hysterical manifestations. The duration varies from a few minutes to several hours, and the interval between the attacks may be days, weeks, months or years. The seizures generally cease quite as quickly as they came on, the short attacks being followed by a desire for food and ability to be about in a few hours. When the attacks have been prolonged (several hours) they are often followed by a feeling of weakness which lasts for several days. In the gastric crises of locomotor ataxia the attacks may be ushered in by a series of lightning pains in the legs, those in malaria occur when the paroxysm of chill and fever is on, and in neurasthenic females the seizures are more liable to occur at the menstrual period (Boas).

The diagnosis is made on the history, the character of the symptoms, the observance of certain constitutional, central, or other organ disease, and the short duration of the seizure. In recurring gastralgias, when no distinct cause can be assigned, examinations for latent or healed ulcer, perigastric adhesions and other conditions should be made. The pains of cancer are more steady, not so severe, and have no free intervals. Blood in the test-meals or feces is not present in true gastralgia, and during the interval of attacks in the majority of cases no secretory or motor change from the normal is observed; a few, however, may have a hyperchlorhydria. Among the other stomach conditions that this may cause confusion with are, hypersecretion, gastromyxorrhea, cardia or pyloric spasms, and achylia. The diagnosis is particularly to be made from the passing of biliary calculi, and in cases of gastralgia in which the pains are not so severe and more colicky in character this may be difficult or impossible for the time being. In the gall-stone cases, other than the definite symptoms, the pains are more to the right of the median line and in the biliary triangle during the interval of attacks, and referred to right side of the body during the colic. The pains of nephritic colic radiate down the back, the crural region, and toward the bladder. Instances of intestinal colic or enteralgia must also be excluded. In these the pain is never sharply localized in the gastric region, may be anywhere in the abdomen, and is usually migratory. Intercostal neuralgia and herpes zoster of the lower left dorsal nerves must also be excluded, and this is done by observing a tenderness along the course of the nerves, and in the latter by the appearance of the characteristic eruption.

Treatment.—In the treatment of gastralgia it is important to direct attention to the underlying cause. The treatment therefore develops itself into that for the relief of the attacks, the treatment in the interval, and that of such other causative factors as may be present. Since the latter are contained under those of the various separate conditions, only the first will be described.

During the attack a hypodermic injection of morphine with atropine may be necessary to quickly control the pains. Hot compresses may be applied to the abdomen in the less severe cases and one of the bromide mixtures may suffice. Chloral hydrate by mouth or rectum answers well when the seizure is prolonged. Foods and drink should be withheld for the time being. The external use of strong galvanic currents, with the anode in the epigastrium and the cathode on the spinal column, has been advised to control the pain. In severe cases strychnine administered as a tonic for a few days may be necessary to strengthen the patient.

In instances of the so-called idiopathic gastralgia, or rather the neurotic gastric form, treatment in the interval is most important. The use of tobacco and alcohol must be interdicted, regular eating habits should be advised, and the taking of cold drinks, soda-water, tea and coffee and strongly stimulating foods should be stopped. The iron tonics or arsenic would be beneficial in anemia, quinine should be given in small doses for about three weeks if there had been a history of malaria, and an underlying hysteria or neurasthenia should be treated by general tonics, good foods, regular living, increased number of hours of rest in bed each day, fresh air, outdoor exercise, massage and the hydropathic measures. In persistent cases, when gastric ulcer, gastritis, and the extragastric conditions can be excluded, the intragastric employment of the galvanic current answers to good purpose. Einhorn advises its use for from four to six weeks. Following his advice, I have noted most striking results from this treatment, but it has been my observation that current from the chemical batteries (from cells) is efficient, while that from a wall plate run by a commercial current is not or only very slightly so.

NEURASTHENIA GASTRICA, POLYSYMPTOMATIC NEUROSIS, OR NERVOUS DYSPEPSIA.

The term polysymptomatic neurosis answers to good purpose for the reason that the condition is a mixed neurosis in which the sensory, secretory and motor nerve mechanism, either combined or alternately,

may play a part. In this work, the term neurasthenia gastrica will be utilized for the reason that it relates to the etiology or causative state, the first and last terms above mentioned being more particularly connected with the symptoms. According to von Leube, the term nervous dyspepsia was intended to cover the group of cases in which the functions of the stomach were normal, while at the same time the patient was suffering from manifold digestive symptoms following the ingestion of foods. Of the cases manifesting changes in gastric secretion and motility, he makes a division into, first, nervous dyspepsia in which no anatomical changes are present in the stomach, and second, nervous dyspepsia in which the changes of gastric secretion are consequential to anatomical defect of the stomach nerves. To these Boas adds a third form of the reflex type from other organs, such as the kidneys, uterus, ovaries, male generative organs and the intestines. Adding to these the constitutional states (diabetes, tuberculosis, syphilis, anemia, debility, the general neurological conditions of a functional nature), the organic stomach conditions (gastritis, ulcer), and the functional stomach conditions (hyperesthesia, gastralgia, states of low secretions of a neurotic nature, the hyper- and hypo-motilities of the stomach of a neurotic nature), it must be plain that the entire subject is much confused, and it might better have been had this condition as a clinical entity never been described under stomach disorders. Still, cases of true neurasthenia gastrica do exist, and by the greatest care in clinical analysis a type of more or less primary neurotic disturbance of the stomach can be noted in which there is no demonstrable anatomical lesion, and which essentially is simply a neurasthenia affecting mostly the stomach and with it commonly the small intestine (gastro-enteric neurasthenia). Considering the functional disturbances, this type or disorder excludes the true sensory neuroses and the high and low secretory and motor condition already described, but it is my firm belief that those that do exist nowhere near make up the many cases that have been and are still being diagnosed as "nervous dyspepsia." Between true neurasthenia gastrica and the other neurotic gastric conditions, the clinical distinctions are drawn so fine that it is only as we view these patients from the neurasthenic side, and following that only by a large number of gastric analyses and long observation of the case, that those of true neurasthenia gastrica can be separated out. It may be argued that such fine distinctions are impracticable or unnecessary. To this in a way I fully agree, for I understand that there is often little difference in the etiology, symptomatology, and even the treatment of the many phases of functional neuroses of the stomach (even more so than with

functional neuroses met with elsewhere in the body). But the day is coming when many of the so-called cases of functional neuroses will be shown to have an anatomical or at least a chemical basis, and, since in some cases it is possible to diagnose true neurasthenia gastrica, the term should only be used to cover those that exist, and not all of the other types of gastric neuroses, a large proportion of which are only symptomatic of other conditions or what may be termed monosymptomatic neuroses, and also neurasthenia in general.

Etiology.—Any of the factors that would deplete the general tone of body in a continued way—diseased, constitutional, unhygienic, dietetic or others—may affect the status of digestion in the stomach to the extent of causing variation in its function, a variation which in toto for diagnosis must be sensory, secretory and motor, not necessarily all combined at the same moment, but at least all present at different periods in a short space of time (from one to seven days). The more deeply these causative conditions assail the general state of body and the nutrition of the neurological system most of all, the more numerous are the cases of neurasthenia gastrica and the fewer those of the simpler and more steady forms of other gastric neuroses. In my opinion, neurasthenia gastrica is never a manifestation or result of gastric disorder or abuse, or in fact that of any other single organ in the body, excepting as such disorders may deplete the general state of health and thus cause irregularity in the most sensitively balanced portion of the living economy—the digestive canal. The proof of this contention is seen in the fact that only about 10 or 15 per cent. of the cases of functional gastric disorders are those of true neurasthenia gastrica, and also the fact that the largest numbers are made up of the hardest mental or physical workers of the two sexes, namely, the men (in the women the more definitely primary or secondary forms of gastric neuroses are the most common). Neurasthenia gastrica may be looked upon as a disturbed physiological condition. When neurologists (who have searched long and ardently without success) find out what the pathology of neurasthenia is, if there is an anatomical one, it can be included in this gastric affection; anatomical lesions or symptomatic states found only in the digestive canal will not explain them. Until that time, much of medical interest in all of the phases of the subject will remain obscured, and all that we can now say is that there are cases of neurasthenia in which the digestive symptoms are pronounced and those of the general body slight or even absent in any observable way. Of interest in this connection is the report of Jurgens, who describes 41 cases of nervous dyspepsia in which at autopsy he found a total degeneration of the Meissner and

Auerbach plexuses. According to this observer, when the symptoms were mostly sensory there was found a degeneration of the muscularis mucosa of the stomach and intestines, a pronounced formation of varices in the intestines, a degeneration of the muscular fibers of the veins and of the sensory nerves and of the branches of the Meissner plexus in this vicinity. Such findings, however, may also be noted in the cases which clinically appear as hyperesthesia gastrica, dilatations and prolapse, gastritis, and even the secretory disturbances; so they cannot be taken as distinctly of neurasthenia gastrica alone.

Symptoms and Diagnosis.—General neurasthenic states are characterized by a morbid irritability and fatigue of the psychical and physical processes accompanied by various sensory disturbances. In these, several groups of locality symptoms more or less combined in body make-up serve to picture the case. The cerebral and mental symptoms are seen in the psychical disturbances in the emotional sphere, and are characterized by a morbid irritability, apprehension, depression, morbid thoughts, lack of power of attention and thus consequential mental inability, and, in the symptoms of fullness and throbbing in the head, occipital headaches, and insomnia. Of the spinal symptoms may be described weariness on exertion, pains and tender areas along the spine, and the sexual disturbances of nocturnal emissions, impaired power, and dread of impotence. To these are added certain urinary and bladder symptoms, and the manifestation of vasomotor disturbance expressed in hot and cold flashes, localized sweatings and more steady heat and cold (usually in the hands and feet), transient blueness, cardiac pains, and irregular, rapid or slow heart action.

The gastro-intestinal symptoms comprise those noted in disturbances of the splanchnic area, which most probably are due to irregularity in the vascular, nutritive or sensory functions of the gastroenteron. Clinically, they comprise no distinctive symptoms, and those that exist may in a running way be most variable. The most prominent and common ones are those of the sensory group coming on after meals, namely, weight, fullness, ill-defined gastric, sternal or back pains, burning or cold feeling in the stomach, and an empty sensation in the stomach even after a large repast. As a rule these are not dependent upon the quality or quantity of food ingested, but rather upon the state of emotions. Sometimes the most digestible foods cause distress, while the most indigestible are borne without discomfort. To the above may be added heartburn, eructations of inodorous and tasteless gas, sitophobia, digestive vertigo, and the

intestinal symptoms of distention, abnormal sensations, flatulency, constipation, or thin, long, cylinder stools at one time and normal-shaped stools at another. The appetite is usually capricious, at one time buliminous and at another stage almost absent. A physical examination of the abdomen is often negative, but tender zones may be noted, as well as localized gas collections in the cecum, colon or sigmoid.

The diagnosis of neurasthenia is made on the history in the way of noting the incongruity and inconsistency of gastro-intestinal symptoms, the more numerous cerebrospinal and vasomotor combinations with them, the observance of the patients, the variable course of the illness during observation, the length of time that it takes for recovery, and the stomach analyses. The more there is of the corporeal symptomatology in the make-up of a case, the surer it is to be a general condition, because here the gastro-intestinal symptoms should be considered as part of the general picture. On the other hand, the greater the intensity of the gastro-intestinal symptoms, and the relatively fewer those of the general body, the surer it is to be a case of what may be considered as true neurasthenia gastrica. This latter in a way is a theoretical distinction, but it answers the purpose for clinical separation, for in so far as the gastro-intestinal symptoms are concerned, in both the more constitutional or the more digestive cases, no separation is always possible by special stomach analyses for the simple reason that the same stomach conditions are present in both. In an effort to clear the great amount of confusion that comprises the last-mentioned part of the subject, I want to state that to establish these diagnoses one must clear the field of all *bona fide* steadily functional, organic, or malignant stomach conditions, as well as those of the other organs accessory or remote to those of digestion. In doing this, practically every stomach condition other than truly neurasthenic states must be excluded. The cases of ulcer, gastritis, prolapse; a steadily running high, low or absent secretion; increased or absent mucus, atony or hypersensitiveness must be relegated to other pathological states than neurasthenia, although in the latter any or all of these conditions may be present or so only for a short time. Now what sort of cases, in so far as gastric analyses are concerned, are truly neurasthenic? Only one type in my opinion, and they are the ones that show more or less steady variation in gastric secretion, motility, and sensation in a running way. A case that shows a degree of changing in the quantities of acid-enzymotic secretion and states of motility, and these spread out in time over months, is always a neurasthenia gastrica and can be nothing else, and those individuals

in whom the gastro-intestinal or corporeal symptoms are intense and persistent and numerous analyses show the process of digestion to be steadily normal are seldom that of clean-cut neurasthenia. A feature of great assistance in holding to the diagnosis of general neurasthenia is the fact that (even if there is a variation in the amounts of hydrochloric acid secreted at different times) the ferments are more steadily present in about constantly even amounts. The secretion of enzyme is much more independent of general body conditions than the acid, and when influenced is more to be taken as an expression of a local condition.

Prognosis.—This is not always favorable, although, as a rule, it is good if the exciting cause can be removed, the general body strength be built up, the treatments are persisted in over enough time, and the patient's financial condition is such as to afford the essentials of treatment. The milder forms yield readily to treatment, most of them requiring about a year of observation when this is conducted in the cities, and possibly half that time in sanatoria treatment in the country. Many patients, handicapped from birth with a weak nervous system, only do well when no especial demands are made upon them and an even tenure of life is carried out; as soon as any physical or mental strain arises they go under. Other cases again, particularly in phlegmatic individuals with more or less abdominal organ prolapse, continue over long periods of time in fair health, but may easily progress on a downward path, lose flesh and strength rapidly, and have relapses on the merest provocation. All of these cases require the strongest force on the part of the physician to have them maintain the essentials of treatment. The psychic spheres of the individual must be favorably influenced, and in accomplishing this the highest art and constant attention to details on the part of the attendant are required. The confidence of the patient must be captured, and the patient must more than feel that the physician is doing all that he can to cure him. The patient must also be made to do what you direct him to, persist in the details of treatment consistently, and assurance to all must steadfastly be maintained that they will eventually get well. Neurasthenics are the individuals who make up the ranks of the metaphysical vagaries and creeds, and it might be better for us to harken to some of the results that these cults are obtaining, rather than rile against them too strenuously. The functional disturbances of the brain are as worthy of our attention as physicians as are the functional disturbances of any other organ.

Treatment.—In all cases in which there is some affection or other ailments these should receive first attention. The patient must be made to feel that recovery cannot be brought about by the use of drugs alone, and that measures of hygiene are of the first importance. Efforts should be made to strengthen the entire nervous system and physical forces. To these ends, change of climate, entire relief from business and perhaps social life, abundant foods, outdoor exercises, more fresh air but not too much sunshine, regular living, sufficient sleep and hydropathic measures are essential. General body massage and electricity of any form are valuable adjuncts of treatment. No attempts at dieting to meet the gastric distress should be engaged in; in fact, the rule to follow is the giving of the largest amounts of foods of high caloric values, irrespective of the gastric symptoms. Tea, coffee, alcohol, and the stimulating foods should be interdicted, and the taking of supplemental meals should be encouraged. The gastric douche may be employed, as Rosenheim suggests, but no direct benefit to the stomach comes from lavage unless gastric hypomotility exists. The ferruginous or arsenical waters may be taken when indicated, or iron may be used in any of the readily assimilated forms. The bromides are necessary in the beginning to control the symptoms, but valerian and nux vomica bring about the best results in the end; the latter two should be continued over long periods of time. Nux vomica combined with the elixir of tincture of iron chloride and gentian, taken diluted before meals, answers best for the anorexia. When constipated, the bowels should be kept open by dietetic means, cascara, phenolphthalein, or enemas, but the purgative waters should not be used. To these ends there should be taken each day at least 4 glasses of water (1 warm before breakfast); fruits, raw or cooked, should be eaten morning and evening; the liberal use of honey, butter, olive-oil or fresh cream be encouraged; a dish of stewed prunes, sweetened with milk-sugar instead of cane-sugar, should be eaten before retiring, and the use of the bran gems (mentioned on page 329 may be employed, with or without butter, at all of the meals instead of bread, rolls, or cake, 3 or more to be eaten each day. Agar-agar may be taken with milk or cream and sugar with or in place of the morning cereal. Drugs from which there is a danger of the formation of a habit should never be employed in neurasthenia.

BULIMIA.

Bulimia is the condition characterized by an abnormal feeling of hunger, and it may be the only manifestation of a primary neurotic condition affecting the stomach, or it may be associated with various other affections. Of the latter may be mentioned particularly ulcer of the stomach, hyperchlorhydria, dilatation of the stomach, neurasthenia, hysteria, tapeworm, pancreatic and intestinal affections, brain tumors, Basedow's disease, pulmonary tuberculosis, diabetes and syphilis. Its duration depends upon the cause, the primary forms usually disappearing suddenly, the secondary forms continuing according to the nature of the illness. A number of theories as to the origin of this symptom have been advanced, all of which still remain to be proven. Of these, however, that of Knapp of contractions of the muscularis of the pyloric region is most interesting, it corresponding to the relief of the symptoms when food had been taken but not to the primary cause which, as was stated before, may be central or constitutional. Knapp states, "As the contraction of the muscularis is the result of irritation of the mucosa, consequently the irritation of the mucosa at any time will produce contraction, which will give rise to the sensation of hunger, and, as soon as the contraction gives way to relaxation, the sensation of hunger disappears." The condition is most commonly found in women, in the proportion of four to one.

Bulimia occurs in periodical attacks lasting for a short space of time, or it may occur chronically. In the neurotic form, which is the most intense type, a feeling of intense hunger occurs with a persistent desire to overcome it. From the gnawing sensation in the stomach, there occurs a degree of fear and anxiety and, unless food is quickly taken, the patient becomes exhausted, feels faint, has ringing in the ears, and suffers from vertigo, headache, trembling and cold extremities. When the condition continues, the patient usually consumes enormous amounts of food in a day in a constant effort at satisfying the intense hunger. As a rule, the secretion and motility of the stomach are normal, but these may be abnormally influenced for the time being. The prognosis depends upon the cause, the neurotic form accompanying neurasthenia or hysteria sometimes disappearing rather suddenly, but in extreme cases this may be protracted for some weeks or months.

The treatment depends upon the primary cause. In the acute and distressing cases, the hourly taking of light meals, the giving of large doses of bromides, or an initial dose of opium would be helpful in controlling the symptoms for the time being. These cases, partic-

ularly, should always be thoroughly examined in the search for some primary cause, and when present the certain gastric neurological or other conditions found should be systematically treated.

PAROREXIA.

Perversions of appetite manifested in a desire for unusual foods have been divided into: (1) pica, desire for articles of the non-food character, such as coal, ashes, earth, chalk, sand, insects, etc.; (2) malacia, desire for special or pungent foods, such as vinegar, mustard, spiced sauces, catsup, green fruits, etc.; (3) allotriophagia, desire for disgusting or harmful substances, such as urine, feces, glass, needles, pins, knife-blades, etc.

Pica and malacia are often observed in the same individual in neurasthenia, and allotriophagia is noted in hysteria, idiots and lunatics. Malacia is frequently noted in chlorotic girls and pregnant women and to an extent is symptomatic of these conditions.

POLYPHAGIA.

Polyphagia denotes that condition in which excessive amounts of food are required in order to satisfy the feeling of hunger. The symptom, in my observation, is not an unusual one in cases of more or less chronically dilated or large stomach observed in certain females, generally of the very slim type. It may be noted as a primary neurotic disturbance, but is also seen in some cases of brain tumor, cancer of the pancreas or spleen, diabetes, convalescence from diseases which have been attended with fever, a few cases of gastritis, and fistulous opening of the gall-bladder. Like bulimia, it may be paroxysmal or permanent.

AKORIA.

By akoria is meant the absence of the sensation of satiety following the ingestion of large as well as small meals. Clinically different from bulimia and polyphagia, the appetite may not be increased and may even be diminished. Like the other symptoms of this group it is observed mostly in the cases of neurasthenia and hysteria, or associated with other diseases, such as diabetes or disorders of the male sexual organs. A neurotic form of the stomach may occur but it is

rare, because a gastritis or an atonic stomach is generally found to account for the symptom.

GASTRALGOKENOSIS.

Boas has introduced this term to indicate the neurosis characterized by the appearance of pain in the stomach when it is empty and disappearing as soon as food is taken. The symptom is a common one in hyperacidity and hypersecretion, but Boas claims to have observed a case in which a large secretion of hydrochloric acid and hyperperistalsis and hyperesthesia did not exist. He believes that the symptom is due to abnormally severe contractions of the pylorus, which become severer toward the end of digestion after the liquefaction of the ingesta, and probably become retarded after new introduction of food. Other than in neurasthenia and the hyperacidities, I agree with Hemmeter that the symptom is an expression of hyperesthesia. Clinically, in most of these cases a thorough purging will cure or at least relieve the case.

ANOREXIA NERVOSA.

A remarkable loss of appetite is seen in some cases of hysteria, in which the desire for food is absolutely lost perhaps for long periods. More commonly this symptom is noted during the course of pyrexia, in debilitating and wasting diseases, in cancer suppurations and tuberculosis, and many other forms of gastro-intestinal disease. It may occur as a primary affection following a severe mental shock, in which it usually rights itself in a few days unless a condition of continued mental depression sets in. In the neurotic cases the appetite is gradually lost, the patient eats less and less, and eschews the solid foods first and then the others. If the condition is continued, the patient loses weight and strength, becomes anemic, and a few cases ending in death have been reported.

In the cases of a nervous type, in fact in any form, treatment is essential. The patient should be impressed with the idea that he must take food, and every effort should be made to supply food in some form. A liberal variety of articles may be allowed, and regular attendance at the table at meal times should be encouraged. Nux vomica, condurango, gentian, cinchona and other bitter tonics should be given, well diluted, five or ten minutes before meals. In the more severe cases, isolation becomes important, the gastric douche, or intragastric galvanism may be used, and perhaps feeding by stomach-tube or nutrient enemata may be essential. In such cases, any form of

stomach treatment in which the tube is used gives one a marked advantage, because, after the spraying or lavaging and before the tube is withdrawn, the running down through it of a mixture of several eggs in milk with sugar may maintain the status of nutrition and add weight if done often enough. The tonics should be given, and the treatment should be persisted in until the former weight has been regained. Rather large-sized doses of strychnine are an important adjunct to the treatment.

NAUSEA NERVOSA.

Under this term is described a purely functional form of nausea occurring in neurasthenia, hysteria and some cases of anemia. As a symptom, nausea is observed in most gastric affections and these need not be dwelt upon here. According to Boas, the functional type is caused by a condition of changing blood circulation in the brain. This seems to be a reasonable explanation because such is no doubt present in the conditions in which it is seen, namely, the functional neurological conditions, menstruation, menopause, chlorosis and anemia, worry, fright, anxiety, etc. In these cases results from the gastric analyses are generally negative.

The nausea may be intermittent or continuous. In the first, the condition comes on independent of ingestion and may occur at any time of the day or night, the attacks lasting from a few minutes to several hours. The continuous form persists for lengths of time, possibly for months, in varying degrees of intensity depending upon the general condition of body and mental state. As a result of the loss of appetite the patients usually partake of limited amounts of food and become run down in strength and emaciated. There are few more trying cases to deal with than neurasthenia or hysteria with nervous anorexia, and it is fortunate that these are not numerous, at least not in a pronounced way. I recently had a trained nurse under observation who, as a result of four months of trying night work in a hospital, developed neurasthenia with pronounced continuous nausea. Although at the time of treatment she was under more favorable conditions, the nausea prevented efforts at feeding, even to the extent of maintaining her equilibrium of weight, and thus she made a steady loss of about three pounds in a week. Altogether she lost 29 pounds in about three months' time, and did not recover until the rest cure supplemented by regular feeding by lavage had been instituted. While she was about, all efforts at feeding, controlling the nausea by drugs, or creating an

appetite by means of tonics, bitters, gastric spraying and galvanism, were fruitless. In every way she was a willing patient, but even the thought of food brought on an intense nausea, vertigo, trembling and various vasomotor disturbances. The treatment in the intermittent and continuous forms of a neurological type is that of feeding by whatever means possible, together with the treatment of neurasthenia. When nausea is a symptom of some definite form of disease, the treatment is that of the primary affection with possibly the bromides, valerian, sumbul, or validol added.

SITOPHOBIA.

This term was first introduced by Einhorn to indicate a condition of hyperesthesia in which fear of food develops, and in which if the condition continues the dyspeptic symptoms gradually increase even after taking the smallest amounts of food. In consequence, the patient develops various neurasthenia symptoms and anemia and inanition. It is probable that all of the severe cases are neurasthenic or hysterical in origin in the first instance, and that the hyperesthesia gastrica is a manifestation of the general conditions. The symptom of lesser degrees of sitophobia is, of course, commonly present in sensitive states of the stomach for any reason, among which conditions may be mentioned gastric and duodenal ulcer, cancer, gastritis, hyperesthesia gastrica, gastralgia and enteralgia, chronic constipation and chronic diarrhea. According to Einhorn, a true "phobia" condition is due to an abnormal fear psychic in character and therefore of cerebral origin. There is no very definite reason to believe that the condition is a clinical entity even in the functional neurological way.

On account of distress or pain, the patients give up the taking of one food after another until the diet is restricted along very contracted lines, and possibly only semisolid or fluid foods are taken. The result of this is seen in the inevitable effects on the general state of health, tone of body, loss of weight, and anemia. Only very small amounts of food may be taken each day, and instances of fatal issue have been reported.

The one essential of treatment is to insist that the patient make every effort to take nourishment, even though it produces distress or pain. In a short time it will be noted by the patient that foods which had caused distress before were then being tolerated with comfort. Supplemental fluid foods (milk, eggs, cream) should be given, and the quantity of solid foods increased until meal tolerance is acquired.

A two weeks' run of bed treatment may be necessary in the beginning, and hot or cold applications, or daily galvanism may be used to control the gastric distress. The bromides, small doses of chloral, belladonna, the alkalies or valerian may be necessary. The treatment is essentially that of hyperesthesia and hyperchlorhydria combined. In practically all cases cure is eventually brought about.

CHAPTER XXX.

Functional Disturbances of the Stomach.

(Continued.)

DISTURBANCES OF MOTILITY.

MYASTHENIA GASTRICA AND ATONIC ECTASIA.

Classification of Primary States of Deficient Gastric Motility.

AMONG the synonyms that have been used for these conditions are gastric atony, motor insufficiency of the first degree, muscular insufficiency, gastric insufficiency, myasthenia ventriculi, hypomotility, gastric relaxation, gastrectasis, and others. The above title terms have been selected by the author for the reason that gastric myasthenia is more expressive of slight states of lowered muscular power (hypomotility) in which delay in the exit of foods is but little or not at all a feature, and because atonic ectasia can be used in definite contradistinction to secondary ectasia because the latter is more expressive of marked gastric relaxation rather than just functional weakened power like myasthenia or primary atony, and lastly because in the extreme grades of low motility for primary or secondary reasons. The author hopes, in his effort to simplify the nomenclature for clinical purposes, that more confusion is not added to this already much confusing subject. The first term pertains particularly to weakened power, the stomach not being increased in size; the second to slight states of relaxation in which the organ is very slightly increased in size; and secondary ectasia (or dilatation) to the much enlarged and thinned out organ due to obstructive conditions interfering with the exit of chyme. Atony from mechanical reasons will be described under secondary ectasia, and under acute post-operative dilatation of the stomach and intestine.

Etiology.—Cannon has shown that the ordinary physical changes expressive of emotion are mainly superficial, manifesting themselves at the periphery and occurring chiefly in the structures supplied with the unstriped muscle fibers and innervated through the sympathetic system. It seems to have been proven beyond a peradventure of doubt that states of emotion, worry, fright, anger, etc., not only affect the

superficial structures but also the similar musculature and nervous supply of the viscera in which these muscle fibers make up large component parts and are intimately connected with organ function. While certain bladder and heart conditions of an increased functional nature are common enough examples of the effect of the state of mind upon these organs, to nowhere near the numbers or extent can they be compared with similar states in the digestive canal. A practising physician need not repair to the literature to learn that this is so, because ordinary clinical deductions in noting the many cases of such that are encountered in practice proves that this intimate association exists in individuals who are not neurasthenic or hysterical in nature. In recent physiological studies of the alimentary canal the importance of emotional states to normal digestion has received striking confirmation, not only in the motor way but also in the secretory activities. Homborg was able to show that the psychic effects of the appearance and taste of foods, shown to exist in the dog by Pawlow, also occurred in the human being. Cannon has noted in the cat that any sign of rage or distress or mere anxiety was accompanied by a total cessation of the movements of the stomach, and that this condition persisted for some time afterward, and also that what was true of the stomach was also true of the peristaltic waves and segmenting movements of the small and antiperistalsis of the large intestine. He believes, deducting from animal experiments, that the vagi convey to the stomach not only the motor impulses generally attributed to them but also the inhibitory impulses, although the splanchnics are the main carriers of the inhibitory stimuli.

It will thus be seen that acute mental states have a powerful influence on the status of motility and secretion of the gastro-enteron. Added to these there is much clinical reason to believe that less acute and more continued running mental states of an emotional type account for many of the dyspeptic disorders that are seen. The baneful effects on the general body noted in such individuals must have some relational connection with the status of digestion. Worry, suspense, anxiety, business and family troubles often show their results in loss of appetite, digestive disturbance, loss of weight and strength, anemia, irritability, various pains, insomnia and constipation. It is probable that these are partly brought about by low running states of motility in the digestive canal (hypomotility or myasthenia). Such conditions when continued over lengths of time may start up a vicious circle by the formation of gases and decomposition products and affect the stomach and general body to such an extent that mild

depend more upon the history and the physical examination for diagnosis.

The subjective symptoms most commonly present in these cases are: loss of appetite or a feeling of satiety from the smallest amount of foods, distress in the stomach after meals which lasts for from one to four hours, greater degree of distress on taking fluids than solid foods, pyrosis, nausea, regurgitation but rarely continued vomiting, belching of either tasteless and odorless gas or that tainted with the taste of the foods taken previously, constipation, headache, vertigo, nervous symptoms of various kinds, palpitation of the heart and indefinite cardiac pains, difficult breathing, and, in the forms secondary to nervous or constitutional disorders, a ravenous appetite may be present. Of these, gastric vertigo (vertigo stomacal) is a distinctive feature in many cases.

In instances of myasthenia gastrica the physical examination of the stomach is negative in every way. In atonic ectasia the stomach is found to be enlarged and lax. The vertical dimensions in all areas of the stomach show a moderate increase in size, and the greater curvature in the prone position reaches to the umbilicus or below in the males and always below in the females; note must be taken that the shape as well as the size of the organ is mapped out so that an atony is not diagnosed for gastroptosis; however, more or less atony is generally present with the latter, although of course it is always secondary in nature. On inflation, the stomach can easily be mapped out by percussion or auscultatory percussion, and its size and shape noted. Splashing or succussion sounds are most valuable to diagnosis, particularly when these are present some hours after a full meal. Water may be given at the time of examination and the splash noted, but it is only when the splash is loud and easily produced that the sign is of any value. If the abdominal walls are very thin and relaxed the borders of a stomach, particularly the greater curvature, may be indistinctly palpable or visible through the abdomen. Gastrodiaphany may be employed, but the X-ray bismuth or hourly X-ray food methods answer to far better purpose. These patients are usually in poor state of nutrition and when young are anemic.

Atonic ectasia must be differentiated from secondary ectasia, gastroptosis, certain nervous disorders of the stomach, neurasthenia, megalogastrica and chronic gastritis.

Prognosis.—States of simple myasthenia usually correct themselves when the local and general conditions of the body are improved. Atonic ectasia is essentially chronic, although the course and variation largely depend upon the ability of the patient to carry out a sustained

the characteristic three layers seen in secondary ectasia; not containing yeast spores, sarcinæ, Boas-Oppler bacilli, lactic acid or blood, the fluid containing a normal total amount (not relative proportion to a small amount of filtrate) of hydrochloric acid and enzyme, and perhaps a hyperacidity in the early stage of the case but which eventually subsides. The mixed or Reigel meal method of examinations are the most valuable. Accepting that a normal stomach should practically be empty of the mixed meal at five hours after the ingestion of a mixed meal (only a few remnants being present), when greater amounts of meat, potato and bread are obtained at five, six, seven, and so on hours afterward it is plain that we are dealing with either a disturbance in the muscular power, a pyloric obstruction, or both together. Since the status of secretion is always important in the diagnosing of gastric affections and the examinations for this in the mixed meals require rather extended laboratory procedure and considerable thought as to the significance of the results obtained, I have adopted a simpler form of procedure for the diagnosing of states of primary atony that answers to good purpose. It must be recalled that when gastric stagnation is present, an empty morning stomach after cellulose vegetable substance taken the night before usually means primary atony or that a mechanical obstruction is some distance away from the pylorus itself, and that when the cellular substance is found true states of pyloric obstruction exist. This means of separation is a valuable one to distinguish the cases by in clinical work. On this basis I have employed a modification of the cellulose method combined with the Ewald meal so that the examination can be made during the day and at one sitting for noting both the state of motility and the state of secretion and still have a simple media to examine for the latter. This is described in detail on page 154.

The time of taking the prunes or raisins is marked upon the card according to the hourly time afterward of the extracting of a mixed meal (5 or more), and the Ewald meal is taken one hour before extraction. Under normal conditions none of the wood fiber from the prunes or raisins should be found in the stomach, and such as is present is easily noted and does not interfere with the analysis of the Ewald meal or its return through the tube. There is one type of case of atony that may give negative findings in these ways, and may give test-meal suggestions like those seen in hypermotility. A marked atonic stomach in which the pylorus is also relaxed generally gives a small test-meal return, perhaps with a low acidity, and always with an absence of the cellulose substance. In these, of course, one must

Of the special treatments, lavage should never be employed, unless there is a definite indication for its use such as in chronic gastritis. Stagnation is never enough of a feature to require stomach washing and the fermentation or neurotic gas collection cannot be stopped by it. More than that, it adds a dead weight to the stomach and further weakens the musculature. If the apparatus and technique are good, gastric douching may be of benefit, but water collection must be guarded against. At these times cold or quite warm water answers to good purpose and it makes but little difference what character of solution is employed. Intragastric faradism with slow vibrations or the sinusoidal currents are valuable adjuncts to the treatment. The external electrode method may also be employed, but it is not preferable. When the symptoms of distress are marked the galvanic currents with the positive pole internal may be employed, but the faradic currents are the best to tone up the muscle walls. In these a good battery capable of delivering both the faradic and galvanic currents at the same time (combined currents) answers to good purpose. Séances should last from ten to fifteen minutes, the faradic current should be used to tolerance and stronger on the back than the front, and the galvanic current from 10 to 25 milliampèremeters. From 15 to 20 treatments given two or three times a week are sufficient to obtain a marked improvement. At the end in constipation cases, the colon can be treated by the currents, or electric vibration or massage can be added to routine. Matters of hygiene and a strengthening régime should be advocated. These are the cases which systematic exercise of a light character benefits most signally; such games as handball, boxing, squash, fencing, tennis, and golf serving to good purpose. The morning sponge or cold rub is serviceable and the patients should not do too much brain work or be too much confined indoors. Women who have primary atony and become pregnant should be watched very closely, kept in bed three or four weeks after labor, nourished very high, bandaged well, exercised to strengthen the abdominal muscles, and be more or less observed during lactation. When patients can afford it an annual routine of a midsummer and midwinter vacation should be advised.

The best drug to employ is strychnine or nux vomica. This should be given all the way through the treatment and in the largest-sized doses that can be tolerated. Belladonna or the oils can be used to control hypersecretion, but bicarbonate of soda should not be employed as an antacid. The bowels should be moved by diet, enemata, cascara or phenolphthalein. The anemia is best treated by dietetic means and the use of the readily assimilated non-astringent

forms of iron. Valerian is of service when the neurotic symptoms are marked, but it is best not to use the bromides. A prescription that answers to good purpose when the atony is accompanied by anorexia and neurosis is the following:—

℞ Tinctura nucis vomicæ,
Tinctura valerianatæ,
Extract condurango .....āā 10.0 ʒiiss
Fiat et Sig.: Take one-half a teaspoonful (30 drops) in water after meals.

SECONDARY ECTASIA.

Motor insufficiency of the second degree (Boas), insufficiency from obstruction, chronic gastrectasis, dilatation of the stomach, gastrectasis, etc., are stagnation or retention states of the stomach secondary to mechanical obstruction in the pyloric region. An idiopathic non-obstructive primary form (not post-operative) has been described but this is too theoretical for practical purposes, still it is possible that acute dilatations of the stomach may occur as a result of the drinking of large amounts of fluid, but this is only a temporary condition. The post-operative dilatations (paralysis) will be described in the next division.

Etiology.—As to whether states of primary atony, even in extreme conditions, ever go on to marked degrees of gastric stagnation, opinions differ. Clinical experience teaches that the degrees of stagnation produced in mechanical obstruction are never seen even when the musculature is in a general state of atrophy, colloid or fatty degeneration, or when penetrated by diffused carcinomatous masses away from the pylorus. Excepting post-operative paralysis, mechanical obstruction is always necessary to produce this type of the organ.

The pylorus or the pyloric region of the stomach may be constricted from within or without. Of the inside conditions are the cicatrices of more or less healed ulcers causing a bridging of the lumen, or a contraction in the circumferential diameter of the lumen and a deformity of the stomach without seriously impairing the full diameter measurement, and various irregular combinations of the foregoing three; malignant disease causing narrowing of the lumen by the carcinomatous masses extending into the cavity of the organ and the resulting stiffening present in the walls; continued pylorospasm interfering with the exit of foods; hypertrophic pyloric stenosis due to thickening of the musculature and contraction of newly formed fibrous tissue in the walls; foreign bodies like resin balls, hair balls, cherry or peach stones; the pedunculated tumors of a benign nature, and kinking

of the prolapsed organ at the duodenal fold. Of the outside causes may be mentioned perigastritic bands stretching across or drawing upon the organ and causing deformity such as may be seen following ulcer, gastritis, cholelithiasis, omental adhesions from appendicitis, liver, infective gall-bladder conditions; pancreatic cysts pressing upon the duodenum, movable kidney particularly following unsuccessful operations of anchoring; floating spleen pressing upon the duodenum; dermoids; and enlarged glands or masses below an indurated ulcer pressing the two sides of the stomach together and generally found in the posterior wall away from the pylorus.

Symptoms and Diagnosis.—The subjective symptoms are those mentioned under atonic ectasia, to which are added the nutritional ones and other definite manifestations according to the disease or condition present. In the secondary ectasias, however, the gastric symptoms are always more of a feature and often most intense. Vomiting, and particularly that of the collective or stagnant type, is a symptom of the greatest importance. In the benign cases or even those of malignant disease not obstructing the outlet much vomiting may be present, but doubts may exist as to whether this is significant in the collective way. It is evident that, when the stenosis is not marked or a spasm element exists, a running fair degree of exit of foods is present, and when mostly fluid foods are taken, vomiting may not be much of a feature and collective vomiting not be seen. This symptom and those of the grades of stagnation depend altogether upon the degree and permanency of the stenosis and but very little upon the condition of the general gastric musculature. Pains are more marked in secondary ectasia than in the primary forms. Tetany or choreiform movements may exist.

On examination of the patient more or less loss of weight and emaciation are commonly present when the stenosis is marked and permanent. In the benign conditions, and even sometimes in the malignant, a fair degree of body nutrition may be noted, particularly when a fluid diet heavy in proteids had been taken for a length of time. It is sufficient to report that even in cancer high proteid fluid feedings may cause the addition of weight for the time being; this depends upon the location of the disease in the stomach and its pathology, namely, as to whether we are dealing with the soft or hard form. When the emaciation is distinct and the stenosis is marked, inspection may disclose peristaltic or antiperistaltic waves running over the organ from the costal margin to the median line; of all diagnostic signs connected with secondary atony these visible peristaltic movements are the most valuable, for up to this time, my experience has

been invariable that when they are present organic stenosis of a high degree exists. Sometimes in a very large and distended organ, a fullness or bulging of the left upper quadrant of the abdomen may be noted and even the extension of greater curvature be seen. Percussion or auscultatory percussion or palpation may be negative if the stenosis is slight, or they may be obtainable in the way of noting a largely dilated stomach. The splash sounds are almost always present, slight and indistinct in slight stenosis, and marked in the severe grades. The gastrodiaphane or, better still, the X-ray bismuth method of examination will display a large globular stomach enlarged in all of its dimensions, and the hourly X-ray food method would be helpful in noting grades of delay in the exit of foods; sometimes, only the pyloric region seems to be dilated, the rest of the stomach appearing normal in size. The gastroscope may be used, but as it is usually impossible to get the pyloric region and pylorus into view, it serves to no value unless there is a running formation of malignant disease extending into the body of the organ.

The examination of the stomach contents yields the most important results for diagnosis. The examination of the vomitus may or may not give definite conclusions depending upon the degree of stenosis, its permanency, its pathological character and its location. In slight degrees, particularly in the benign conditions, nothing of importance can be gained and the employment of the hourly mixed test-meal analyses is essential. In several grades, the large, dark-gray or brown achylic return, with lactic acid, blood, pus, long-retained food particles, a fluid which separates into the three layers on standing is characteristic of that due to malignant disease. The vomitus may be very fetid, and considerable subjective relief is generally experienced when the organ had been emptied. In lesser degrees of stenosis, particularly in the non-malignant conditions, great dependence can be placed upon detailed observation of the test-meal method of diagnosis. In ulcer and other benign conditions the hydrochloric acid may be normal in a unit of quantity and have increased amount of bacteria giving more than 2 per cent. gas result (Ewald meal) in the fermentation tests. At the end of five hours after a mixed meal (when the normal stomach should practically be empty) quantities of red meat fibers and the other foods are obtained, and as these in quantities run through the six, seven, eight and so on hour extractions the various grades of stenoses can be judged. In high degrees of pyloric stenoses the morning stomach after a mixed meal given the night before usually contains some of the food, and the simple testing method of Mayo is valuable toward these ends

(page 153). Employing aspiration, an acid return with food, with or without blood (occult or macroscopic) or mucus and free from lactic acid and the lactic acid formers argues in favor of benign stenosis, either intra- or extra-gastric in origin. In all stenoses the test-meal returns are bulky depending upon its degree. Many sarcinæ argue in favor of benign stenoses against cancer, although the yeast fungi may be found in both. These points are dealt with in detail under the gastric analyses of the various conditions.

In high degrees of stenoses the urine is diminished in quantity. Some have classified the grades according to the amounts secreted, claiming an output of 1000 to 1500 cubic centimeters for the mildest; 500 to 1000 cubic centimeters for the medium, and under 500 cubic centimeters for the severer grades. In making these examinations the day's collection should be started with a lavage of the stomach in the morning and at the end of twenty-four hours an aspiration of the stomach should be made. It is evident that as much fluid as a normal person would ordinarily take should be out of the stomach in the morning and be represented in a daily output of over 1500 cubic centimeters. Naturally, with a patient in bed, the greater the discrepancy between the intake and output of fluid the more significant this would be.

Such urines may be alkaline in ulcer, and acid in cancer. A phosphaturia or albuminuria may exist, and acetone and diacetic acid be present. Acetone urines are more common in ulcer than cancer. The blood usually shows an anemia, represented both in a diminution of the hemoglobin and the number of red cells.

Heinrich Landerer in 1879 reported a series of 9 cases of congenital stenosis in the adult, varying in age between forty-three and sixty-three, in which at autopsy he could demonstrate a narrowing of the pylorus and which he believed to be of congenital origin. Since that time Maier, Maylard and others have reported cases; so there is little room for doubt that this is a correct interpretation of the lesion. These cases usually give a chronic history of gastric distress and evidences of mild or moderate degrees of stagnation or retardation of foods. The recognition of this clinical entity is particularly interesting in the light of similar lesions in infants whose clinical manifestations are now quite familiar, and can be found described in Chapter XXV, together with the 2 adult cases I have seen, both of which had very much enlarged organs with seven- and eight-hour large test-meal returns after the mixed meals. These adult cases require pylorectomy or pyloroplasty as the operations of choice, very few of them being permanently relieved by gastro-enterostomy as strange as this may

seem. This latter is probably due to the chronic course of the condition and the fact that the tendency is for the food to follow the normal exit and thus the gastro-enteric opening is liable to close.

The differential diagnosis rests between atonic ectasia and other forms of gastric disturbance, dilated colon, prolapse, neurasthenia gastrica, gastric crises, the esophageal conditions, and the various types or character of stenoses. These are described under the various disorders. Very often, particularly in the slight or medium grades of stenosis, all we can conclude is that a degree of permanent stenosis exists (which by the way for many cases is a perfectly practical and complete enough diagnosis), and it is necessary for surgery to find out just what its character or source may be.

Prognosis.—In the early stages of secondary ectasia one should be exceedingly careful to guard against too definite assertions as to the cause and outcome of the affection and the results from treatment. These cases should be carefully analyzed and closely watched, and resort made to surgery when improvement is not noted or is not sustained. The outcome and the possibilities of treatment, both medical and surgical, are bound up in the character of lesion, degree of stenosis and the possibility of its removal. The minor and medium grades of a benign nature are often most amenable to medical treatment; the severe forms require surgery in the first instance. Cancer is more of a surgical condition in its early stages than in the late. Pylorospasm, gastroptosis and mild states of perigastric adhesions are essentially medical conditions. Marked post-ulcer cicatricial conditions, hypertrophic gastritis with distinct retention, large foreign bodies or pedunculated growths within the organ, marked perigastric or omental bands from any cause, pancreatic cysts of large size, dermoids and large-sized benign extragastric deposits or movable spleen or kidney generally require surgery. The cases that are remanded to medical treatment should have constant attention, either in the direct treatment or prophylactic ways. In obstructive cases of a benign nature when not of severe degree the treatment should always be medical at the onset. Many of these cases become perfectly comfortable and satisfied with the results. In those in which this is not so, in whom relapses are frequent and the gastric symptoms are more or less continuous or the general state of health fails, surgery can render a benign stenosis of no importance in itself. Many surgeons believe that all pyloric stenoses of any degree are operable cases in the first instance, and some of the internists temporize with even the severe cases too long. It all depends upon the nature of the case and the results that can be obtained with treatment. There is no definite

ground either way to suit all instances, for the simple reason that a diverse pathology runs through them. The matter is altogether one of pathological diagnosis, the willingness and intelligence of the patient in following directions, the personal equation and judgment of the physician, and the value of service that he renders in the treatment.

Treatment.—The essentials of medical treatment are dietetic, general and that rational to the cause and degree of stagnation. The dietetic treatment is essentially that mentioned under the early treatment of hyperchlorhydria and also that included under atonic ectasia, excepting that the foods must always be given in the fluid, semifluid or finely comminuted forms. Stagnation must carefully be guarded against, and those foods that give distress, ferment, or on aspiration are observed to remain in the stomach too long must be changed in form or discontinued. The best results are obtained by frequent small meals, about 6 in a day. Occasional lavage assists materially. In a medium degree of stagnation when symptoms of distress come on acutely after the taking of improper foods, a quick vomiting, lavage or ejection of the food by means of a stomach-tube would relieve the symptoms. When such attacks are frequent surgery is indicated. Repose in the recumbent or left-sided position after meals is helpful. The bowels should be moved by enema. Medication to relieve the stenosis is useless, excepting olive-oil may be employed before ingestion and occasionally gives good results. When the medical treatment serves to little purpose, surgery is indicated, pyloroplasty, pylorectomy, partial gastrectomy, or gastro-enterostomy offering brilliant results in the non-malignant forms of stenoses of gastric origin.

ACUTE POST-OPERATIVE DILATATION OF THE STOMACH AND DUODENUM.

As has been mentioned, a mild degree of acute dilatation may occur as a result of indiscretion in diet or drinking; as a complication of the acute infectious diseases (pneumonia, typhoid, acute tuberculosis, scarlatina); as a sequel to continued disease of a debilitating nature; in head injuries and brain and spinal cord disease; the idiopathic cases probably being due to functional or toxic disturbances of an obscure nature; and the post-operative cases. The latter only are included in this chapter, and since such are much more frequent than is generally supposed, and being a most fatal form they are worthy of separate description.

Etiology.—The causation of this type of dilatation is still much of a matter of conjecture. The view most generally held is the hypoth-

esis of Albrecht that a purely mechanical obstruction of the duodenum by the root of the mesentery and the superior mesenteric vessels occurs due to the sinking of the empty intestines into the true pelvis. Albrecht, and other observers, believe that this sinking of the small intestine is not sufficient to produce complete obstruction, but that it does produce obstruction enough to cause some degree of overfilling and distention of the stomach, and that this prevents the small intestine from returning to its physiological place in the abdomen, and thus a vicious circle is set up. In defense of this view are the facts that conditions of prolapse (enteroptosis) accompanied by relaxation of the mesentery are commonly present in the cases, and the beneficial results that are obtained by the lavaging of the organ and the postural method of treatment.

Another view, directly opposed to the foregoing, is that a functional disturbance of the stomach is a primary feature in the process, and that the distention of the stomach, independent of any constriction of the duodenum, forces the small intestine into the pelvis and in that way causes the tension on the mesentery and the duodenal obstruction. In defense of this contention may be mentioned all of the toxic, traumatic and disease factors which can cause this condition; the fact that even in enteroptosis a practical degree of mechanical obstruction is rarely met with; the fact that males and females are affected in like proportions; and the acute onset of the condition. While it is possible that in some cases the first-mentioned cause may be an initial factor, there is no doubt that a primary functional rather than a primary mechanical disturbance is the cause in the largest majority of cases. This latter view is held especially by Stieda and von Herff, who says: "The more I study the condition the more I am convinced that acute paralysis and paresis of the stomach are caused by injuries to its nervous apparatus; that these injuries are probably in the nature of trauma to the spinal column; that in a certain number of cases they occur as the result of the toxic action of chloroform, or possibly ether or toxins formed in the stomach. For a certain number of cases there seems to be no satisfactory explanation as yet." Thoma also holds to these views. Kelling, on the other hand, thinks that a valve-like action of the cardia is the most important etiological factor in many cases, and seems to hold rather strongly to the mechanical explanation above offered as the correct one. The facts are that acute dilatation occurs frequently with narcosis, and that dilatations are exceedingly rare in operations, even severe ones, performed without chloroform or ether. It is, therefore, feasible that the general anesthetics themselves cause merely a motor insufficiency and thus may be

looked upon as an additional or an exciting factor, the distention of the stomach with liquids, solids or gases, poor states of vitality, neurological conditions, inflammations and prolapse also being necessary in the make-up of causes. Braun and Seidel[1] (who regard arteriomesenteric obstruction as a secondary phenomenon) undertook a series of observations and experiments to clear the confusion in the etiology of this condition. They conclude that (1) acute dilatation of the stomach is an expression of and a result of acute gastric motor insufficiency; (2) this acute motor insufficiency can affect a stomach previously healthy, as well as one the subject of a chronic or atrophic process; (3) it may occur as an independent disease or as complication of other diseases; (4) the acute motor insufficiency of a previously healthy stomach is in the vast majority of cases of a purely functional and not a mechanical nature; (5) these functional disturbances are alterations of gastric innervation (central, peripheral, and reflex) and injuries to the gastric musculature; (6) all the surgical forms of acute dilatation may be explained on the basis of a disturbance of innervation, as well as most of those occurring in association with infectious diseases and with constitutional and other ailments; (7) a direct injury to the muscle fibers through mechanical, inflammatory or toxic lesions is possible, although gross histological changes have thus far not been observed; (8) motor insufficiency and consequent dilatation occur as the result of a damming back of ingested materials, decomposition processes, or abnormally increased secretion; (9) acute motor insufficiency may occur in the absence of a predisposing factor, in a healthy stomach with intact innervation, as the result of profound dietetic errors or abnormal decomposition of ingested material; (10) acute dilatations occurring on top of chronic dilatation are usually induced by mechanical factors; (11) primary acute pyloric or duodenal occlusion occurs but seldom, and can be diagnosticated only when evident anatomical or mechanical lesions are present; (12) arteriomesenteric occlusion cannot be looked upon as the cause of acute dilatation, but only as a frequently unimportant result of the primary functional gastric dilatation; (13) the existence of a valve-like closure of the cardia has not been proved, and is not a necessary condition to acute dilatation of the stomach. In so far as the operative form is concerned it is important to remember that the condition can follow any type of operation upon any part of the body, about one-half of the cases occur following laparotomy. The latter fact has caused much to be written upon the subject of traction on the duodenum, trauma from the handling of the abdominal viscera, large incisions, pressure upon the kidney, etc. as dangerous performances in operative procedure in the

abdomen. It is only necessary to recall that operations upon this part of the body make up about one-half of the major surgical cases, and that these operations are usually severe and prolonged. In my opinion, the matter is more one of the amount of anesthetic that has been given according to the general and local condition of the patient, and but very little matters of surgical technique. The quicker the operation, the less the danger of post-operative dilatation. In addition to the effects of the anesthetic, I believe that a depressive form of neurological condition, operative upon the musculature of the gastro enteron and due to the apprehension and fears of the operation, and added to this the operative shock has much to do with its development. Take the more common enteric and colonic post-operative distentions, which are mostly paretic or paralytic in nature, why is it that these are more common following operations upon the sane than insane and also on the highly organized and intelligent as compared with the more ordinary types of individuals? It has often occurred to me that this psychical or central cause has to do with the production of quite a few of these gastroduodenal cases also.

Symptoms and Diagnosis.—In a general way three fourths of all cases follow operations on patients between ten and forty years; the younger and older the patient, the less the danger. The time of operation and the amount of anesthesia being equal, no type of operative case is especially prone or exempt, males and females being about equally affected.

The definite gastric symptoms may be most acute and characteristic or may be absent. Naturally, the more severe the dilatation the more sure it is these would be present; still, markedly dilated stomachs in serious cases may exist without vomiting, pain, tenderness, thirst, or scanty urine, all of which are characteristic symptoms. The onset of the attack when severe is generally sudden. The patient survives an operation and the post-operative course appears normal possibly as long as two weeks afterward. Suddenly, a distention of the stomach takes place accompanied with profuse and persistent vomiting of large amounts of fluid; pain in the epigastric and [illegible] which may be steady or colicky, tenderness [illegible] and symptoms of collapse. Muscular rigidity is usually absent [illegible] against a peritonitis. The abdomen swells from the enlargement of the stomach, the right hypochondrium becomes prominent and the left flattened, and the general gastric [illegible] an enlarged organ, the lower border being [illegible] sibly extending almost to the pelvis. The [illegible] the organ is also increased [illegible]

mammillary line; epigastric tympany also is usually observed. On the passing of a stomach-tube to relieve the gaseous distention and lavaging to wash out the fluid, the size of the organ quickly diminishes. The stomach may be so distended with gas that the succussion sounds may not be noted. Visible peristaltic waves may occur, but they are rare in the severe cases, being more common in the moderate grades that have existed untreated for several days.

A treacherous type of severe case may exist in which the characteristic symptoms are absent or are too slight and indistinct for definite diagnostic purpose. These are seen in the post-operative cases in which anorexia and gastric fermentation or intestinal flatulency have been present in a running way. Suddenly, for no assignable reason, a quick change is noted in the appearance and general condition of the patient. The countenance becomes dusky or pallored, the facies pinched; the pulse more rapid, smaller and thready in character; the temperature drops and may even become subnormal; the hands and feet cold, and the abdomen more or less distended. Such cases may not show much on examination of the abdomen, although the right upper aspect may be slightly prominent. In them the succussion sounds are more regularly present, but the pain may not be very definite. As vomiting may not be present and stagnation of the stomach always exists, dependence must be placed upon the use of the stomach-tube for diagnosis, and fortunately this method of examination is usually conclusive, although its use in lavaging the organ is not so often curative as in the first form. These cases are an alarming fatal type, death usually occurring within a few days.

The most favorable cases are those of the milder types in which the paralysis may be said to be incomplete. These comprise varying grades and are about evenly divided between the post-operative and mixed cases, such as occur in typhoid fever, pneumonia, etc. In these the onset may be slower and more indistinct, and the abdomen examination negative in any conclusive way. Noting the history of cause and remembering that the possibility of this condition in any degree always exists following operation, the diagnosis is suggested by a patient suddenly becoming an unfavorable case for some obscure reason. In the mildest grades one or two vomiting spells emptying the stomach may change the appearance of the individual almost as quickly as was the onset of the unfavorable symptoms. The quick recognition of the condition, and the early resort to the stomach-tube treatment saves the majority of these individuals. In my opinion, in these slight cases the intestines may be mainly affected and in this instance general gaseous distention and constipation are diagnostic features.

Particularly in the severe cases, the return from the stomach is free of hydrochloric acid, and lactic and other organic acids may or may not be present, but bile is not an uncommon finding. In the less severe cases more or less hydrochloric acid and enzyme are found. The return generally contains more or less food particles, a rather large amount of fluid, and possibly blood.

Among the other symptoms that can be noted are: scanty urine, constipation, subnormal temperature, thirst, general muscular cramps, tetany, hiccough and delirium. The diagnosis must particularly be made from peritonitis, intestinal obstruction and perforation.

Prognosis.—The prognosis in severe cases with typical symptoms is bad, about 70 per cent. of them dying in a short time. Every one of the cases that I have seen (5 in number) in which the gastric and abdominal symptoms were not much of a feature and the constitutional symptoms were quick and decided, terminated fatally in a few hours. The prognosis in all cases must be carefully guarded. The cessation of vomiting is not always a favorable sign; this may be due to the patient becoming so weakened and prostrated that vomiting is no longer possible. More reliance should be placed upon the general condition of the patient, and the diminution in the amount and character of the return from the stomach obtained by the stomach-tube. When bile, steapsin and succus entericus and no gastric enzyme are constantly seen, the prognosis continues grave. When an achylic return slowly develops into one having hydrochloric acid and gastric enzyme, the prognosis becomes more favorable. Should there develop a fecal odor to the gastric contents or a return of fecal substance itself, the diagnosis must be changed to intestinal obstruction below the duodenum.

Treatment.—At once when the diagnosis of post-operative dilatation of the stomach and duodenum is made, all foods and fluids should be withheld by mouth and the rectal route of feeding preferred. In the severer cases with a sudden onset, early rectal feedings are not important, the enemas of infusion of coffee or other stimulants being first in order. In every case, both severe and mild, the stomach should immediately be evacuated, preferably by lavage with plain warm water, so as to relieve the pressure exerted by the organ, to clean out the fermenting contents from further poisoning the body, and to act as a stimulant to contraction. The main reason for the use of plain water is that it answers all purposes and still leaves possible the examination of such stomach contents as are obtained. One must not wait until the symptoms appear marked, and in temporizing with emetics we can never be sure that the organ is empty. As Conner rightfully

advises, the lavagings should be frequent, several in twenty-four hours, and in severe cases the distention and accumulation cannot be kept down unless this is done about every three hours. The severer the case, the more frequent the stomach washings, every one or two hours not being too often in the beginning. The lavagings should be kept up for several days, according to the existing conditions. It is safer to lavage too often than not often enough. Thirst should be combated by protoclysis or hypodermoclysis. Rectal feedings should be kept up until the gastric condition has almost cleared. These cases die or get well quickly, and thus the rectal feeding for a few days answers all purposes. The bowels should be moved by enema (preferably saline solution), and hot turpentine stupes may be used to relieve the distention. The best purgative to employ is a single dose of elaterin in the form of trituration elaterini 0.03 (½ grain) by mouth; calomel is too slow and not efficient, castor-oil is too slow and may give violent gastric pains, the salines are too bulky and irritating to the stomach, and croton-oil is dangerous. Elaterin is a powerful and quick hydragogue cathartic, and early watery stools are beneficial to these toxic patients. Supported by strychnine injections, I have yet to see bad or depressing effects come from its use; on the contrary, I have reason to believe that it is a valuable drug in these cases. An efficient means to move the bowels and cause the discharge of gas in an enema of 30 grammes (1 ounce) of pulverized alum in a pint of water. Atropine and strychnine should be given hypodermically; the atropine to relieve any possible pylorospasm and control secretion into the stomach, and the strychnine to benefit the paralysis and overcome the shock. The strychnine should be pushed in the beginning, giving about 0.003 (1/20 grain) hypodermically every two or three hours, and its dose slowly decreased as recovery occurs. The giving of eserine is malpractice; cases in which it had been used have gotten better in spite of its use, not because of it. Strychnine is a far more efficient and safe drug to use to overcome the paresis.

The next most important item of treatment is the postural method. There seems to be considerable difference of opinion as to which of the four positions serves to the best purpose. The half-sitting position and lying flat with the head of the bed blocked up have been advised for the type of dilatation which accompanies pneumonia when the cardiac and respiratory symptoms are marked. These postures relieve the pressure in the lower thorax and in that way relieve the embarrassment on the heart's action and the frequency of respirations. In the post-operative cases it seems logical to suppose that, while relieving the pressure on the diaphragm would serve to some purpose in so

far as the chest is concerned and even favor downward drainage from the stomach, at the same time it would also increase the danger of a lower position of the small intestine and thus increase the element of mechanical obstruction upon the duodenum. For this latter reason the elevation of the foot end of the bed has been advised. Others have favored the side position, usually the right, to encourage drainage of the stomach, and some even, notably Schnitzler, have employed the abdominal position (abdomen down). A combination of a tight bandaging of the lower abdomen or the use of the Rose bandage together with the half-sitting position may serve to good purpose, but as many of the patients have a laparotomy wound this bandaging is not practicable. Of late, I have been advising a combination of the two dorsal positions and it seems to answer to good purpose. The procedure can easily be carried out by blocking up the head of the bed and placing a number of hard pillows under the thorax and head so as to keep these high. A couple of wide boards are next placed in the bed, one extremity resting over the elevated foot end and the other just under the hips. The patient is placed so that the back is bent in the lumbar region, at which the thorax and head on one side and the hips and lower extremities on the other are elevated at the same time. This permits a fair degree of relief to chest embarrassment and also permits of a higher plane to the enteron. Not all patients can keep this position in comfort continuously, but those that complain the most vigorously are usually the ones that are getting well, and after that any of the other positions that gives the most relief can be taken.

At the subsidence of the symptoms, mouth feeding should be instituted. In the beginning only milk should be used and this must be given in small quantities and preferably peptonized. Later on, the quantity at each feeding can be increased (up to ½ a glassful), followed by raw eggs in milk, bouillon, strained gruels, rice, farina, and so on up to the more solid foods. The dietetic care during the convalescence of these patients must be carefully watched all the way through to complete recovery, because fatal results have been reported on the too early use of such foods as uncooked fruits, meats, etc. Operations have been performed for the purpose of draining or evacuating the stomach or relieving the duodenojejunal kink. These in my belief are unjustifiable procedures. The mild and moderate cases generally recover on the medical measures, and the severe cases do better without operation than with it. Furthermore, the severe cases are most unsuitable for any form of severe operative procedure,

and it must always be remembered that the condition came on from operation in the first instance and it is unwise to add a second to intensify the condition.

CARDIOSPASM.

Under normal conditions there is a spasmodic contraction of the cardia by which both solids and fluids are momentarily delayed in their passage into the stomach. This spasm may be pronounced in certain neurological conditions so that entrance of food is obstructed and the accumulation of ingesta in the gullet above the cardia causes a dilatation of the esophagus, either local just above the cardia (lower one-third of the esophagus), or general as is seen in the long-standing pronounced cases. The anomaly can be purely functional in nature, when it is a manifestation of hysteria, neurasthenia, and marked anemia, or it may be secondary to certain diseased conditions of the cardia, lower gullet or stomach, as may be present in traumatic injuries from foods, ulcer, cancer, or the stomach conditions of an irritative type. No doubt many minor degrees of cardiospasm exist which are not diagnosed, either because the condition is transitory or incomplete or because our attention is not directed to the condition. The symptom of slight states of difficulty or low sternal pains on swallowing running over a short time is quite a common history in many gastro-intestinal cases. The neurotic type, clinically, occurs in two forms: as a transitory paroxysmal affection lasting from a few hours to a couple of days, and as the chronic form which may extend over a few years.

Etiology.—The affection has been attributed to the following causes: primary cardiospasm due to failure of the central inhibitory influence controlling contraction of the cardia (Mikulicz and Meltzer), primary atony of the muscular coats of the esophagus (Rosenheim), both a functional disturbance of the innervation of the esophagus causing cardiospasm with a concomitant weakness of the muscular wall brought on by paralysis of the vagus (Kraus), congenital disposition (Fleiner, Leuker, Luschka), primary esophagitis (Martin), and kinking at the hiatus œsophagi.

While it is probable that primary atony of the esophageal muscle can occur in rare instances, clinical observation and treatment of the cases in which esophageal dilatation is present teach us that this is generally secondary to cardiospasm. As a rule, the cases give a history of cardiospasm over lengths of time and the dilatation occurs after that. This conclusion is further borne out by the evidences of early muscular hypertrophy in nearly all cases which have come to post

mortem, and by the numerous cases of cardiospasm that exist unaccompanied by dilatation of the esophagus. Other than this, the different theories are largely speculative and based upon too few observations.

The condition occurs at any age, and is most frequently seen in females. Excitement is occasionally an important factor, and the affection may occur after continued air swallowing. Neurasthenia, hysteria, anemia, the local disease, and the reflex causes make up the great majority of cases.

Symptoms and Diagnosis.—According to Plummer,[2] the development of cardiospasm may clinically be recognized in three stages: "1. In this stage the peristaltic contraction of the esophagus is sufficient to force the food through the spastic cardia. This is characterized clinically by the complaint of discomfort, pain, choking sensation, etc. 2. The peristaltic force of the esophageal muscle is no longer able to overcome the resistance of the contracted cardia, and the food is immediately regurgitated. This may result from an actual or relative increase in the obstruction at the cardia; that is, the spasm may become accentuated or the esophageal muscle may tire under the usual load. In some cases the spasm is sufficiently severe from the onset to cause the immediate regurgitation of food. As a rule the spasm is, during the early part of the history, periodic; but as the condition develops mild spasm becomes more continued or constant. Marked exacerbations in the spasm characterize the entire course of the disease. The increased work of forcing the food past the contracted cardia results in an early hypertrophy of the esophageal musculature. As the spasm increases in severity the esophagus becomes less and less able to overcome the obstruction, and atony and dilatation result. 3. Once the esophagus begins to give way the dilatation is rapid. This stage is characterized clinically by the retention of food in the esophagus and its regurgitation at irregular intervals after ingestion. If the spasm is mild for a sufficient length of time from the onset, the hypertrophy may become extreme and dilatation not take place or be delayed for years. The hypertrophy, after becoming well developed, may overcome a most marked resistance at the cardia. Relatively frequent severe spasm at the onset may lead to early dilatation before hypertrophy of the esophagus has time to develop. An impaired tone in the esophageal muscle at the onset of the trouble may also have something to do with the rapid early dilatation that takes place in some cases."

As a rule, the symptom-complex of cardiospasm is characteristic, although in the mild degrees of acute form this is masked and

only suggestive. In the majority of cases the attack of spasm occurs suddenly and unexpectedly while eating. The attack is manifested by a burning, tightening and pressure sensation with indistinct pain behind the lower part of the sternum, the pain radiating to the back and neck. A dysphagia is present in the effort to force the foods into the stomach, accompanied by the sensation in its passage of the foods being arrested at that point. If this is continued, the accumulated food is regurgitated, causing at times some dyspnea, a relief of the symptoms of distress following the emptying of the gullet. The condition comes on periodically, and during the interval the patient is free from discomfort and able to swallow normally. In the more chronic forms, the acute attacks are more frequent and last longer at each seizure. Regurgitation and dyspnea are more of a feature, and perhaps only fluid and semifluid foods can be ingested for some days. The final stage of a continued case is that of esophageal dilatation in which the acute symptoms on taking foods are absent or much modified, and those of regurgitation of accumulated food some time after ingestion prominent. In these, solid foods, like meat and vegetables, may be delayed at the cardia for several days, the softer and fluid foods passing through in the mean time. At this time, dysphagia is a noticeable feature and more or less constant, and continuous burning sensations from the irritation of decomposing foods in the esophagus are complained of. Such cases may regurgitate hundreds of centimeters of fluid several hours after a meal, usually during the night when the recumbent posture had been assumed for a little time. Such returns contain no hydrochloric acid and gastric enzyme and the foods are in the form swallowed, these evidences pointing to the fact that the regurgitation is esophageal in origin and not a true vomiting from the stomach. Even in the benign cases blood may be present, although this is more characteristic of malignant disease or ulceration. The second deglutition murmur is absent or much delayed, and the sign of Rewidzoff would not be present. Loss of weight is noticeable in the majority of cases, and in those of long standing in which esophageal dilatation exists, emaciation, invalidism and even death occur. The general effect on the body is altogether one of how much food can be completely swallowed to maintain nutrition. In some instances even the fluid foods cannot be taken in sufficient quantities, and in these the general condition is progressively downward. The X-ray method of examination is liable to lead one astray in these cases. It is plain to understand that a picture taken in the marked acute cases during the seizure, or in the more chronic cases during the interval, may show the sausage-shaped bismuth-food mass in the gullet (the

lower pole being at the cardia) at one time and not at another. In the more marked cases the appearance may be that of an organic or malignant stricture, large diverticula or idiopathic dilatation or sacculation of the esophagus; more detail on these is included in Chapter XVII.

The diagnosis is made on the obstruction to instruments (bougie or stomach-tube) through the canal in the effort to gain entrance into the stomach. The medium-sized olive should first be used, with which a resistance would be met with at the cardia and which gives way on a gentle degree of pressure; the resistance gradually being obliterated on the in and out passage of the olive through the cardiac orifice. A slight degree of resistance more easily obliterated may be noted with the smaller-sized olives, while the passage of the larger ones would be more difficult. In the normal adult, the largest-sized olive that is ordinarily supplied with the set of tips should pass a cardia with but little resistance. One may feel a resistance at one time when the symptoms are on, and at another time the same-sized olive would pass freely. In the marked cases aspiration of the gullet above the cardia may give considerable return. A simple plan is to give a meal of soft, unstrained gruel (rice best) in which about 20 drops of the ordinary 0.5 per cent. solution of dimethylamidoazobenzol had been added; which does not change its color perceptibly or, if so, to only a faint yellow. In about fifteen minutes the stomach-tube is passed and aspiration performed at the point of resistance. If the gruel had reached the stomach a brilliant red color to the return is noted (changed by the free HCl), and if it remains white or yellow only the gullet had been aspirated (the organic acids that may be present in the stagnation of such a gullet do not affect the color of the reagent).

In organic and malignant strictures the stenosis is not easily overcome by the passage of the instruments; in fact in most of the cases the stenosis becomes worse as time goes on. In differentiating the various conditions, the use of the esophagoscope becomes essential; in cardiospasm nothing locally would be noted, and when passed under an anesthetic resistance would not be observed, while in the organic and malignant the strictures may be seen and the stenosis would remain permanent. Care must be taken, in cancer cases of the body of the stomach or pylorus, that these are not mistaken for those of only advanced cardiospasm. The main reason for this is because achylic and stagnant returns are commonly obtained from the stomach in cancer and secondary cardiospasm may be present. In uncomplicated cardiospasm the returns from the gullet are negative in reaction or show the presence of only small amounts of organic acids,

the returns from the stomach showing hydrochloric acid. In cancer of the stomach without stenosis of the cardia, the Boas-Oppler bacilli may swarm in the lower gullet region; in fact, I may incidentally state that they often can be found in the mouth and feces in large numbers.

Prognosis.—The outcome of all of these cases is good providing the condition is recognized and proper treatment instituted.

Treatment.—In the acute and periodical forms of a minor nature all that is necessary is to give attention to the nervous system and general nutrition of the body. The feeding should be high in caloric values and general in character, the irritating and bulky foods and drinks being eliminated. Baths, sufficient rest, regular exercise, abundant fresh air, proper routine of life, etc. should be insisted upon, and the general tonics and reconstructive medications employed. Belladonna and the bromides should be used regularly when the spasms are severe and often, and the quantity should be pushed to tolerance in the beginning and maintained at a medium level afterward. The bowels should be moved by simple medical measures, and any form of gastro-intestinal disturbance properly treated. As strange as it may seem for spasm cases, nux vomica or strychnine is a useful drug to employ in all of the cases, particularly when esophageal dilatation exists. The weak galvanic or faradic currents of high frequency to the gullet are useful in the routine of treatment, and the electrical treatments should always be terminated by the outside electrode being held for some moments on the side of the neck over the pneumogastric, particularly the left.

When the stenosis is marked, mechanical measures to overcome the spasm are essential. The bougies can be used, the size of the olives gradually being increased up to the largest. These should be passed regularly according to the exigencies of the case, and the olive should be held for some moments and frequently drawn through the cardia at each treatment. Various forms of dilating instruments have been advanced for the treatment of these cases, all of which are useful particularly when the condition had stood for some time and hypertrophic stenosis of the cardia exists. Of these the Plummer dilating apparatus, which consists of a whalebone staff with an olive drilled to permit a string being drawn through and a dilator, is useful for the extreme cases. The process of introduction comprises the swallowing of about six yards of silk thread which passes down through a sufficient number of coils of the intestine to prevent its withdrawal on being pulled taut. The string is swallowed on two occasions, 3 yards in the afternoon and the remaining 3 yards in the morning some time

before the dilatation. The drilled olive is now passed down over the string on the same principle that a tunneled sound is passed over a filiform whalebone through a deep urethral stricture. This insures the entrance through the cardia with the least amount of mechanical injury. A tube with a rubber silk bag 22 millimeters in diameter is introduced over the whalebone staff and distended with water under sufficient pressure so as to make the stylet, tube and balloon form a solid sound. The sound is drawn up to locate the cardia, collapsed to draw it through into the esophagus and cardia, and then distended again. In this way larger-sized bags can be used successively until no further resistance is met with at the cardia. As only a few of the cases are so extreme that a single dilating instrument cannot be applied

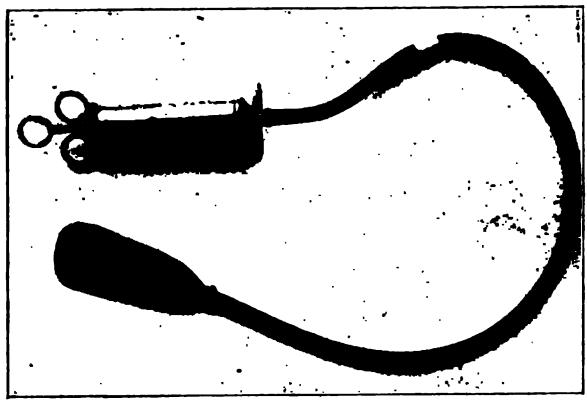

Fig. 108.—Author's cardia dilator.

directly (in marked cases the regular stomach-tube cannot be passed through the cardia without a dangerous degree of pressure), the other forms of dilators answer to complete purpose. Among these may be mentioned the Sippy dilator, which is introduced with a bougie but which is not very easily manipulated from below into the cardia, and the Einhorn instrument, which is a mechanical instrument having two parallels of steel at its lower end which are separated by a screw from above on the same principle as the urethrometer. A rather inexpensive device, that can be assembled from the office equipment of most any physician, has been used by the author in 27 cases of cardiospasm and has answered in all excepting 1 case in which the Plummer apparatus had to be employed.

The assemblage consists of an ordinary stomach-tube with closed end into which a sufficiently strong steel wire is placed to stiffen it.

The wire is first passed through the tube and out of the lower side fenestra, the distal end of the wire being looped so that it does not puncture the lower end of the tube on introduction. The wire is then withdrawn a little distance up through the tube and the proximal end cut so that when the loop is in contact with the lower extremity of the tube and the upper end of the wire extending only to a little distance beyond the mark on the tube that corresponds with the teeth when the stomach-tube is introduced into the stomach. At this measurement, the loop end of the wire is again withdrawn through the fenestra (about 4 centimeters) and the upper end is driven through the side walls of the tube, bent, and fastened in place with a strip of adhesive plaster. A piece of sufficiently strong rubber sheeting or, better still, the lower end of a spinal ice-bag is slipped over the distal end of the tube (not taut) and fastened on the tube about 10 centimeters from its end by means of several circles of an elastic band (2 bands being stronger) in back of which the rubber sheeting or bag is trimmed off. When using rubber sheeting, another rubber band is placed near the extreme end of the tube. An ordinary metal ear syringe (or any kind of a hand syringe) of about 50 cubic centimeters' capacity is used to inflate the lower end with water. The procedure of its manipulation is identical with that described with the Plummer apparatus excepting that hand pressure is used. The assembled apparatus should be tried before introduction so as to notice that no leakage occurs and to see that the proportion between the capacity of the apparatus will hold the contents of the syringe without bursting the rubber balloon. The lower end of the instrument should be introduced into the stomach collapsed, and the syringe attached and held onto the tube until the manipulation and treatment are over. By using a larger syringe, by pushing the rubber band on upper part of the bag downward nearer to the distal end, or both together, different degrees of dilatation can be readily and safely accomplished. The incorporation of a water pressure gauge is not essential, excepting to note the degree of cardiac resistance. There is no danger of overloading the cardia with the simple apparatus described.

PYLOROSPASM.

Pylorospasm of only a neurotic nature is a rare affection occurring probably in not more than 0.1 per cent. of all stomach cases. It is much rarer than cardiospasm, and in by far the largest number of cases the condition is secondary or symptomatic of some other affection. The condition is usually due to some form of irritation causing a cramping or tonic contraction of the pyloric muscle, and is found more

frequently in females than in males. As a neurosis it may occur at any age but most often in those of early life. As a symptom of *bona fide* gastric (other than neurotic) and extra-gastric conditions pylorospasm is quite common.

Etiology.—An explanation of the cause of the neurotic cases has not been advanced, but several cases of nervous spasm have been described by surgeons in which at operation instances of non-pathological spasm was noted. In the largest number there exists such conditions as hyperesthesia, hyperacidity and hypersecretion, gastric and duodenal ulcer, gastroptosis, gall-bladder disease, cancer at the pylorus, and the reflex irritation from disease in other abdominal organs.

Symptoms and Diagnosis.—At the height of digestion the pylorus suddenly becomes spasmodically contracted, the patient experiences an intense pain in the epigastrium radiating from the median line accompanied by eructations independent of food, nausea and perhaps vomiting and general symptoms of distress. In the majority of cases seen, a history of these attacks at intervals in the past is obtainable, the disorder appearing periodically at first, and finally becoming more continuous. Rather steady vomiting of stagnant foods then becomes a feature, and symptoms of hyperesthesia and hyperacidity may be present in the interval. The symptoms of gastric dilatations are then observed, and in long-standing cases a very large atonic stomach may be present. The spasm may also come on during the night.

On examination during the attack, a sharply located tenderness corresponding to the pylorus is noted and perhaps a firm pylorus felt. The general abdomen may be retracted from spasm of the recti, and gastric tympany is usually pronounced. In the interval, a less distinctly localized tenderness in the region of the pylorus is commonly observed. The gastric analysis during the attack may show anacid, normal or hyperacid contents depending upon the time that the onset of the cramp occurred and its degree. The gastric returns in the interval may be normal, or show a hyperacidity or hypersecretion depending upon the length of time that the condition existed, the extent of dilatation, the degree of neurotic disturbance, and the presence of the pathological factors that can produce pylorospasm reflexly. When the attacks are frequent and dilatation exists, stagnation of stomach contents occurs in degrees depending upon the associated conditions. The mixed meal method of examination shows gastric contents at six, seven or eight hours after ingestion. In these instances rapid emaciation, oliguria, severe constipation, increased thirst, and perhaps bulimia would be present. Conditions of tetany

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pu... alkalies some time after meals are
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b... doses are of benefit; a prescription
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.....	4.0	ʒj
.....	60.0	℥ij
.....	250.0	℥viij

...ful every four hours in a little water.

... severe, hot applications or a sinapis
... may be sufficient without the morphine.
... agastric galvanism is a valuable item of
... current should be employed; faradism is
... cases not even when atony exists. When

stagnation is present in a running way, lavage with quite warm alkaline or nitrate of soda solutions should be employed, only lukewarm or cold solutions never. An underlying neurasthenia should be combated by the treatments for that affection, and as long as this exists no promise of continued relief should be made. If after faithful trial no relief or only slight relief is obtained, or a gastric ulcer or its sequel or a continuous hyperacidity or hypersecretion is believed to be present, exploratory operation should be advised. Pyloroplasty and pylorectomy are usually the surgical procedures of choice; gastroenterostomy, recommended by some authorities, has failed me on four occasions, the symptoms of pylorospasm in all returning inside of two years' time.

HYPERMOTILITY NERVOSA.

While hypermotility as a symptom is commonly present in the irritated stomach, such as would accompany gastric ulcer, hyperesthesia, hyperacidity, or hypersecretion, there is no doubt that this condition can occur as a clean-cut neurosis of a continued form in which such states as gastrospasm or pyloric incontinence cannot be recognized as the clinical manifestation. It is possible that this condition may be a mild form of the so-called peristaltic unrest of Kussmaul, but in it the characteristic peristaltic waves of the latter are not observed externally, the stomach can never be felt and still the stomach empties most quickly. The general use of the X-rays in the diagnosis of gastric affections often produces some surprising observations. The cases are not so few in which a plate taken immediately after the ingestion of the bismuth food mixture shows a large amount of the bismuth well advanced into the small intestine or spattered in spots of irregular outline all over the plate excepting at the sides which correspond to the colon and lateral walls. It may be argued that such cases are only instances of pyloric incontinence, but every one of these stomachs (and I have observed many) can be inflated with air which it retains about a normal length of time, and the examinations of the empty as well as the full stomach never display intestinal contents, bile and pancreatic secretion in the organ. Furthermore, these cases preserve a relationship between the exit of the various forms of food, but with all forms the time of elimination from the stomach is much shortened. It is inconceivable to me that a pylorus could be relaxed so as to permit the stomach to empty within a few moments and not display a like result with all forms of food that ordinarily are taken, and also that a chronically relaxed pylorus would have the single action of only allowing passage from the

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[illegible] observed in well-nourished individuals, not commonly neuras-
[illegible] or neurotic in nature, in whom the symptoms are more of intes-
[illegible] grouping.

Symptoms and Diagnosis.—Excepting the above-mentioned states [illegible] functional hypermotility is observed and considering only the [illegible] cases, the following may be presented. The condition is [illegible] by dietetic influences, rather than general or central, and as [illegible] found in those who habitually partake of large amounts of [illegible] soups, coffee and condiments. In my experience they are [illegible] among the Germans, and those who habitually partake of [illegible] foods. The symptoms are subjective and those noted by gastric analyses and X-ray observations. Those described are: anorexia, flatulence and stomach distention after meals, hyperesthesia to the richer forms of food and not so much to the simple or foods in small quantities, post-meal eructations, and looseness of the bowels accompanied with much gas formation in the intestine. In other cases only anorexia is present with a disturbed sensation in the mouth and the intestinal symptoms predominate; the latter of which are only mildly so or not at all relieved by a thorough purging. The return of a simple meal at the usual time shows a very small amount with a correspondingly low hydrochloric acid acidity, or in fact the stomach may be empty at the proper time of extraction. Examination at forty-five-, thirty-, and fifteen-minute intervals shows corresponding grada-

tions in quantity, the largest return being noted at the fifteen-minute interval. A carefully weighed out mixed meal shows a like result, excepting that the time for its elimination is about double that of the simple meal and the amount of meat content proportionately higher than the carbohydrate. The stomach is generally empty of the mixed meal in two or three hours' time. The morning stomach is always empty and no intestinal secretions are noted. Observation by the X-rays shows an increased peristaltic activity of the body and fundus of the organ, and the radiographs already described. The diagnosis must be made from the other conditions in which hypermotility is symptomatic; from pyloric incontinence, primary atony, other neurotic states of the gastro-enteron, and the benign intestinal or accessory organ conditions.

Prognosis.—In all cases the prognosis for complete recovery is good, relapses not occurring if the necessary indications are observed in a continued way.

Treatment.—In the neurological form of hypermotility, the main indication of the diet is for the employment of solid foods. Fluid or semisolid substances may be taken in the midmeal interval, but overlapping with solid foods or too high caloric feedings should be guarded against. Of course, the foods should be simply cooked and as free from condiments as possible.. The taking of soups, broths, tea, coffee, alcohol and tobacco should be stopped, and in severe cases the assumption of the left-side prone position after meals may be desirable. Lavage, douching or electricity should never be employed, not even when a large flaccid stomach exists. The bromides in large-sized doses or the regular use of codeine are the most efficient medications. In my experience, the acids usually increase the symptoms, nux vomica does not benefit them, but olive-oil taken before meals may be helpful for a short time but should be stopped as soon as improvement sets in. The purgatives should not be used, and if constipation exists the use of simple enemata would be the safest plan to install. An anemia should be combated by the use of foods high in the proportion of iron (page 712) or the non-astringent forms of iron. The general hygienic measures or a sojourn in the country are most substantial to control an underlying neurosis, and if the symptoms of neurasthenia are present these should be combated in the usual ways. The diet, however, in caloric values must be held down for the first month or two, and after that only very gradually increased. The low degree of enteritis that is usually present in these cases passes off if the dietetic indications are observed.

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n As a rule, the onset is gradual, at first
becoming a marked feature. In the beginning
be suppressed, but when the habit is well
may be impossible. The regurgitations may be
chronic, becoming intensified after certain meals, and
states of neurasthenia or general conditions. The his-
is usually that of rapid eating, and states of chronic
are commonly observed. When the condition is well
established, the constant loss of foods and efforts in dieting for its
relief cause emaciation and anemia. When the condition develops
into merycism subnutrition is not so common.

The diagnosis is differentiated from vomiting in that nausea or definite emptying of the stomach or the other conditions do not exist; from merycism in that the food is not swallowed again; and from eructations in that food is delivered into the mouth in large quantities instead of only gas or stomach fluids. The cases must also be diagnosed from those of esophageal or cardiac stenoses, and this is easily done on the history of the case, the noting of a patent gullet with the instruments, and the examinations of the returned food for the stomach secretions.

Prognosis.—This is almost always good, and for continued relief is usually dependent upon the results obtained in the treatment of the neurasthenia. Some of the cases, which may be termed a chronic neurasthenia, or a neurotic temperament most susceptible to true neurasthenic additions, are difficult to treat and only get well after extended observations.

Treatment.—The general condition of the patient requires first attention, and the neurasthenia and hysteria should receive appropriate treatment. The patient must be made to make efforts to suppress the regurgitations by voluntary control and slow eating and thorough mastication should be insisted upon. At times when the spells are on, freedom from work and continued rest should be advised. In severe cases the rest cure with isolation may be necessary. Intragastric faradism is valuable in some cases. The best medications to employ are strychnine and the bromides, and a good combination to employ is the following:—

℞ Strychnia sulphatis	0.03	gr. ½
Sodium bromidum	20.0	ʒv
Elixir phosphori	60.0	℥ij
Aquæ ad	250.0	℥viij

Fiat et Sig.: Take a tablespoonful plain followed by water, fifteen minutes after meals.

MERYCISM.

Merycism, "chewing the cud," or rumination, is that condition in which the foods are regurgitated into the mouth when they are again masticated and then either reswallowed or ejected. The condition is either a development of neurotic regurgitation or acquired by imitation. The first are seen mostly in neurasthenia, and the second in hysteria. Several pathological and physiological explanations have been offered for the condition, and from its similarity to rumination in certain animals an hereditary explanation has been offered, but it is probable that the three above offered account for all cases seen. The instances in which heredity seems to play a rôle are probably explained along the lines of imitation, because the histories of family ruminants all show a direct descent and no instance of the condition in children during the first few years of life. The condition may develop as a result of sudden mental shock in a highly sensitive individual, and also is not uncommon among idiots and insane.

Symptoms and Diagnosis.—The duration of merycism is very variable, it being all the way from periodical attacks to a continuation during the whole of life. At first, it begins as a voluntary process in which a subjective sense of pleasure is experienced, and later it is involuntary. The regurgitation occurs when food had been taken and continues for the time after a meal until the foods are unpleasant to the taste. As soon, however, as it becomes acid it is either swallowed quickly without mastication, or ejected. Should an anacidity be present the rumination may be continuous during the day as long as there is food in the stomach, the condition not being present when the

stomach contains only its own secretions or saliva. The diagnosis is made without difficulty, and can be confounded with nothing else excepting some cases of marked nervous regurgitations, from which it may be said that the distinction is not important. All degrees of gastric secretions have been reported, from anacidity to hyperacidity; so it is most probable that the state of gastric secretion is not important in its production. The prognosis is good if the patients are anxious to control the condition; not so if they are not. Relapses may occur after some mental strain or shock.

Treatment.—The most important item of treatment is for the patient to gain control of the habit, and further treatment than this is unnecessary in some of the patients. When this cannot be done, an absolutely fluid diet should be installed for a few weeks, following which slow eating and thorough mastication must be insisted upon. The alkalies should be used in hyperacidity, and the mineral acids in low or absent acidity. The eating of ice after meals has been warmly recommended (Koerner). The taking of strychnine and quinine after meals is helpful in the moral way of giving an unpleasant taste to the foods, and also as good general tonics. The bromides and valerianates serve well in the routine of treatment. Intragastric electricity may be efficient in some of the cases. Lavage, douching, spraying, and gavage are not indicated. In the neurasthenia and hysteria when the general state of health is poor, the hygienic, hydropathic, high feeding and psychotherapeutic treatments are necessary, but the patient should be kept under observation until the rumination is controlled; after that a sojourn in the country for several months would serve of value, particularly when some relative or friend is present who quickly expresses disgust when the symptom is noticed.

ERUCTATIO NERVOSA.

This condition occurs in periodic or paroxysmal attacks of noisy belching of odorless and tasteless gas. It is found in neurasthenia, hysteria, or as a result of a mental strain or shock. It is distinctive from states of fermentation or putrefaction in which eructations are present from the fact that in the latter the gases are generated in the stomach, while in the neurotic form the gas ejected is the returned air that had been swallowed (aërophagia). In my experience, the condition is not so uncommon in atony or prolapse of the stomach, particularly in young women. Linnosier believes that aërophagia is much like regurgitation excepting that air instead of stomach contents is ejected. Ewald contends that the condition originates in the œsophagus, beginning primarily by contraction of the muscles of the

neck. It is probable that Oser's theory of air aspiration (during inspiration) into the esophagus and stomach is the manner of air introduction, because in the instances I have observed distinct habits of air swallowing have always been denied and could not be proven in any of the cases. It is more common in females and in the younger women.

Symptoms and Diagnosis.—The condition persists from a few hours to several days. When it is prolonged, intervals of relief are common, the condition coming on again when the patient's attention is drawn to the condition and when under mental strain or medical observation. Attention is attracted to the affection by the patient emitting a succession of loud eructative explosions rather regularly every few minutes, each manifestation perhaps being accompanied by a distressed expression in the face. The attacks are not present during sleep or when the patient's attention is engrossed on some outside matter. On examination nothing definite can be found excepting that the stomach may be very tympanitic. For this latter reason states of prolapse or atony can easily be noted on the first examination. The diagnosis is not difficult, although states of fermentation, such as accompany gastritis, malignant disease and other conditions, must be eliminated. This is done by test-meal analysis.

Treatment.—The patient must make an effort to control the symptom. When this is difficult measures for treating the neurasthenia or hysteria are essential. In the long-standing cases the rest cure is required. Electricity to the gullet (faradism) sometimes answers to good purpose. The diet is indifferent but should contain no stimulating foods or drink. In my experience large doses of bromides answer well to quickly control the symptoms, and valerian serving best for a continued routine of treatment. When prolapse or atony of the stomach is present, it must be corrected by proper measures.

SINGULTUS GASTRICA NERVOSA.

Singultus, or hiccough, is a symptom expressed as a sound made by the sudden and involuntary contraction of the diaphragm, and the simultaneous contraction of the glottis which arrests the raising air in the trachea. Depending upon its cause, singultus may last for a few minutes or several hours or be continued, and also it may recur during days and months. Among the numerous conditions in which it may be present may be mentioned—the diseases of the abdominal viscera (gastritis, primary and secondary ectatic gastric atony, gastric carcinoma); enteritis, internal and external intestinal obstruction or other causes of intestinal obstruction or paresis (such as the post-

stomach contai[illegible] [illegible]s (usually sup-
made without [illegible] when it involves
excepting som[illegible] [illegible]neum); and tym-
may be said [illegible] [illegible]ic conditions of the
gastric secre[illegible] [illegible]seases of the nervous
so it is mos[illegible] [illegible]ningitis, hydrocephalus,
tant in its [illegible] and certain constitutional
anxious to [illegible] nephritis, some cases of
occur afte[illegible] [illegible] pleurisy, dysmenorrhea and
Treat[illegible] [illegible] disease, typhoid fever and typhoid
patient t[illegible] [illegible] The type of case I particularly wish
unneces[illegible] [illegible] is a functional nervous form occurring with
absolute [illegible] which is not hysterical in character.
which [illegible] [illegible] recent article of mine[3] in which I drew attention to the
The al[illegible] [illegible] these cases, I again present the following: "Nervous
low o[illegible] [illegible] merycism, regurgitation and eructations all pertain in
recon[illegible] [illegible] to a return of gastric contents as the main symptom. In
meal [illegible] [illegible] gastrica nervosa a continuous hiccoughing lasting over
the [illegible] [illegible] of time varying from weeks to months and without any gastric
val[illegible] [illegible] at any time may be seen. The condition usually accompanies a
tri[illegible] [illegible] hyperesthesia of the stomach glandularis likewisely continuous while
in [illegible] hiccoughing is the feature. As a condition it is rarely met with
v [illegible] by me in only 2 cases of several thousand neurotic stomach con-
[illegible] and most probably usually in well-nourished young adults,
and most often in the female. When more of these cases have been
studied it is probable that an argument will be presented that those
of singultus nervosa gastrica are only those of hysteria in which a
continuous hiccoughing is prominent. Against this I wish to argue
that the close study of these 2 cases in the way of heredity, past his-
tory, cause, imitation, syphilis, hemorrhages, infectious diseases,
chemical toxic causes (lead, alcohol, tobacco) and the usual symptoms
of hysteria were not present, and both of them had *bona fide* gastric
hyperesthesia accompanying them. The most careful examination in
both failed to elicit any skin anesthesia, hyperesthesia or paresthesia;
had pain, emotional crises; were mentally excitable or depressed; had
loss of emotional control; were impulsive; had spinal or vertebral
pains, globus hystericus, vasomotor disturbances, disturbed sleep, som-
nambulism or cerebral automatism, paralysis, contractures, tremor,
ataxia or choreic movements, absence of skin reflexes, complete loss of
concentric limitation of the visual field or disturbance of color sense;
manifested the presence of hysterogenic zones, pseudo-angina,
aryosthemia, constipation and other of the less common clinical symp-

toms commonly found more or less regular in the course of hysteria. Both of these cases were exhaustively examined by competent specialists, among whom were neurologists, ophthalmologists, gynecologists and others, and both of them were considered normal in all other respects, and I therefore believe that such a neurotic condition of the stomach does occur, the cause of which is primarily situated in that organ, and that this gives rise to involuntary contractions of the diaphragm as a reflex manifestation.

CASE I.—Female, 29 years old; first came under observation in my clinic April 10, 1908. Her family history was negative, her father being alive and well, her mother dead from an unknown cause, and she having several brothers and sisters all of whom were well. History of nervousness, epilepsy, alcoholism, etc. in the family negative. Her personal habits had always been good; she ate rather heavily of the substantial plain foods at regular meal times, drank nothing alcholic, lived a happy and comfortable married life, and had no worry in particular excepting that she had not become pregnant and this did not affect her much. Her bowels moved regularly once or twice a day.

At the time, she complained of gastric distress which had begun about four months before, and had been in the care of two physicians. The symptoms she complained of were a burning distress in the stomach after meals (even those of the lightest kinds), accompanied with epigastric distention, a weight in the upper abdomen and a pressure in the lower sternum and chest. At these times some difficulty in breathing was present, occasionally headache, and a condition of nervousness from the distress at the time. At intervals, usually after a meal or a more abundant meal than usual, she claims to have had attacks of pain in the stomach (gastralgia) which necessitated her removing her corsets and perhaps going to bed. On two occasions a physician was summoned, hot applications to the epigastrium were applied, and in one an injection of morphia was given; these seizures ameliorated after three or four hours' time and the pains passed off in about two more (probably when the stomach was empty of foods).

Following a purge the night before, an Ewald test meal was extracted which showed a return of 70 cubic centimeters, which was normal in macroscopic and microscopic appearance, a total HCl of 60°, a total acidity of 65°, and nothing else worthy of note. Examinations of her stools and urine were negative, and her blood showed 4,470,000 reds, Hb. 89 per cent., 6000 whites and the morphology of the reds and differential count of the white cells was considered normal. The physical examination was negative; the woman was well nourished, her stomach was normal in shape, size and position, and nothing abnormal was noted in the abdomen, chest, mouth, etc.

On these findings the diagnosis of hyperesthesia gastrica with slight increased gastric secretion was made, and the case was treated with a work down blood diet consisting essentially of milk, cream, butter, eggs and well cooked cereals in amounts equal to 3000 calories per day, and small doses of bromide of soda and tincture of valerian. She reported at intervals of two or three days for about four months, during which time she made a rather slow but steady recovery. At the end of the sixth week another Ewald meal was extracted which showed a decrease in the hydrochloric secretion to about one third of the former amount

she reported to have
mination it was sus-
so on a subsequent
ments were discontinued
ds of simple foods and

the following history. The
ms after its birth. She says
she was troubled with attacks
s she had had no gastric dis-
during the last two months of
born, she began hiccoughing, at
ng more frequent and pronounced.
following her labor, became most
m of the former gastric symptoms she
tion and again sought aid.
by several specialists in the clinic and
that she was about the same type of a
hiccoughing at intervals of about three
decidedly less although not altogether
test-meal extracted a few days after her
ally a normal condition of stomach. On
ns of the diaphragm were observed at

st troublesome to treat in that no measures
the diaphragmatic contractions. However,
soda (10 grammes per day), she gradually
e weeks of this treatment was hiccoughing
above mentioned was again instituted and
lowered, and she finally made substantial
sual weight she was short 10 pounds.

of the condition I draw attention to, the
eing a feature of the gastric neurosis,
y induced by the spasmodic contractions
agm—a condition common in pregnant
the vomitings of the early months of

Mrs. E. B., 34 years old; housewife; mother of two
e youngest 3 years; family history negative; habits
egularly, lived a simple and happy home life, and
and coffee and nothing alcoholic.
always been moderately constipated, although when
water and ate fruits twice a day her bowels moved with-
she has had some minor attacks of stomach distress in the
late winter when she had been housed up too much.
order of slight degrees of distress in the epigastrium,
and passing off with a little care in the selection of foods

she partook of and at which times she always had taken a purge. She began with "stomach trouble" in the first part of February of the present year. She awakened one morning with a frontal headache, became nauseated, and vomited shortly. Toward afternoon the headache subsided (took aspirine), the nausea became less prominent and she began to hiccough at intervals of about once every hour. On the following day she left her bed, the nausea was less pronounced, the vomiting had stopped but the hiccoughing continued. Gradually, there intensified a distress after the meals consisting of weight, depression, and distention in the epigastrium, eructations of inodorous and tasteless gases and a more noticeable constipation. Sometimes when the distress was marked there were pains radiating from the cardiac region to the left shoulder and back. At these times she felt weak and often was troubled with palpitation. From the onset of the acute attack the hiccoughing continued, becoming more frequent and regular. Fearing to intensify the always present distress in her stomach and particularly to augment the hiccoughing, she kept eliminating certain foods—even the simple ones—until she was living on only small amounts of milk before I saw her. However, no measures at dieting seemed to assist her, although under medical care of two physicians, the first of whom said she had "kidney trouble," the second "anemia" (the writer 'phoned the first attendant who said that he did not find albumin or casts in her urine). She steadily ran down in weight until just before going to bed she was 27 pounds short of her original weight.

On my first visit she was in bed where she had been for five days, too weak to be about, and had not slept any to speak of in that time. Her emaciation and anemia were noticeable, her face drawn and anxious, hiccoughing without regurgitation about every four minutes, and tossing restlessly in the bed. She had an aversion for foods and drink of all kinds, had taken only small amounts at the earnest solicitation of her husband, and altogether looked desperately ill. On careful physical examination nothing particular was found excepting that her stomach was markedly tympanitic and the pyloric region reaching to 2 centimeters below the umbilicus; a hemic, cardiac and jugular murmur, and a regular pulse of rather small quality and a rate of from 105 to 120.

The laboratory findings of specimens obtained during the three days following were: Blood, red cells 3,100,000, Hb. 62 per cent., white cells 7750, differential count normal. Feces light colored, food particles normal, Gram differential stain not significant, no blood or mucus, 10 grammes of feces in 25 cubic centimeters of water fermenting 23 per cent. of gas in twenty-four hours and inoculation showed 31 per cent. in the dextrose bouillon. Ewald meal, 79 cubic centimeters return, starch apparently well digested. Free HCl 21°, combined HCl 29° (total HCl 50°), total acidity 57°, enzymes normal quantity, no blood or increased amounts of mucus. Urine. 24 hours, 995 cubic centimeters; specific gravity 1021, acid; no glucose, albumin or casts, and indican; oxalic acid and uric acid in slight excess; chlorine and nitrogen content normal, sulphate content slightly raised, urea 11 grammes.

The above-mentioned clinical condition ran on progressively for over three weeks. The day's consumption of food by mouth and retained on any one day was never more than 1500 calories, and 1000 more nearly represented the daily average. The hiccoughing was incessant day and night, and the acute distress caused by even small quantities of food or drink in the stomach showed that a high degree of hyperesthesia of the glandularis was present. Rectal feedings were resorted to and fortunately they were well borne.

for some time, the patients lose in weight an
become more nervous, and the anemia may be ma
vomiting spell is quickly over, a few moments aft
may again partake of foods which remain in the s
cases the skin becomes dry and the urine scant fr
of fluids to the body. In the periodical form the p
ill, and, the vomiting continuing, mucus and
terminal ejecta. In these cases a degree of abd
complained of, and there be considerable vertigo,
constipation marked, and the secretion of urine a
time being.

The diagnosis is made from the history, chara
the noting of general neurological symptoms of
the absence of any positive findings in gastric a
tion of conditions in other organs that may reflexl
the poor results obtained from the usual remedie
ordinary vomiting and the almost magical res
valerian and the hygienic measures. The diag
from all affections in which vomiting is a sympt
beginning this may be somewhat difficult the n
form soon becomes apparent.

Treatment.—Not considering the juvenile
may be divided into those for each of the clinic
however, the chief aim is to remove the cause an
as would build up the general tone of the body.
only requires a short time employment of sedati
vomiting because the condition quickly corrects i

In periodic and reflex vomiting absolute rest
To these ends, quick relief of the symptoms is b
a single hypodermic injection of morphine or the
suppositories. A mustard plaster to the epigastri
tions to the head often are efficient in controllin
when this persists the mouth or, better, the rect
bromides and possibly also chloral hydrate in s
The sucking on pieces of ice over which a litt
poured offers some relief. It is best not to use t
preparations, although aspirin is often of service
eral symptoms of distress. On recovery, the
examined for the cause of the manifestation and
absence of these a sojourn in the country and hyd
would prove of value. There is nothing partic
diet, excepting that when the symptoms are inte

withheld for a few hours, and in the interval high caloric feedings should be maintained.

In the persistent form (idiopathic vomiting), the routine of treatment is somewhat different. These cases may be divided into those that succeed on ambulatory treatment, and those that do not or are the very long continued or extreme types. The history as to mode of life and other details of like nature must receive attention and advice be given to correct or minimize them as much as possible. Special treatments for the vomiting *per se* usually are not successful. Change of scene may be necessary, and the avoidance of mental excitement, worry, anxiety, suspense, late hours, trying work, etc. must be controlled. No regard should be placed on the vomitings, and the patient should be told that the symptom is not important or serious and should always make direct effort to control its occurrence. Special dieting serves to no distinct purpose, excepting that frequent small-sized meals may be desirable. Sometimes the solids are retained the best, sometimes the fluids. The most efficient drugs are the bromides and valerian and these should be taken regularly in large-sized doses. Concerning them it may be said that even when employing large doses it may take a week to control the vomiting. After this event the doses should be reduced, but still continued over some weeks of time. The hydropathic treatments are of benefit, and electricity may serve of value in the moral way. In the more extreme cases the institution of the rest cure may be essential for recovery. Feeding by gavage for a period may be helpful at the onset, during which time self-feeding should not be allowed. Faradism is a more efficient procedure in the bed cases than in the ambulatory. After the bromides, the special or general tonics should always be given for a length of time.

PNEUMATOSIS.

Under the above term are classified a group of cases in which the stomach is distended with air, the expulsion of which seems impossible. Many of these cases correspond to the so-called asthma dyspepticum of Henoch, and may be conditions of aërophagia excepting that the air is not regurgitated as in eructatio nervosa. Other instances are seen in cardiospasm, pylorospasm, atony, dilatation, prolapse, neurotic temperament, neurasthenia and hysteria. It occurs as a periodic or continuous condition, brought on or intensified by mental strain or states of general body. The condition is more common in males, and is generally seen in individuals of the intellectual type.

fc
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... epigastric and
... per abdomen may
... anitic. When these
... rt to belch without
... a difficulty in breath-
... great anxiety from the
... and irregular pulse and
... ntion is not so marked,
... of dyspnea be less distinct.
... be normal, or of high or low
... nder my observation showed
... bed in neurasthenia gastrica.
... story and the exclusion of other
... common, and from angina pec-

... the most efficient procedure is
... tube to relieve the distention and to
... this the symptoms of dyspnea, etc.,
... ssage of the tube may have to be
... comfort. In the continued cases the
... ecessary. If a tube is not at hand, the
... a hypodermic injection of morphine
... e even after a tube had been used. Ten
... mpositus or spiritus menthæ piperitæ or
... ened hot water, or 5 drops of oleum tere-
... a lump of sugar may relieve the distention by causing
... The routine of treatment comprises that for the underlying
neurosis, neurasthenia or hysteria, for which states it may be said that
strychnine or nux vomica should be given. Physostigmine and
... indica have been recommended in the routine of treatment
... against the recurrence of attacks, but these are not as efficient
... mides, codeine, and the valerianates.

PERISTALTIC UNREST.

... ndition was first described by Kussmaul as occurring in
... individuals, in whom excessive peristalsis caused annoy-
... cramp-like sensations and visible contractions of the stomach.
... visible peristaltic movements are most generally seen in
... of the pylorus, a neurotic form not due to stenosis may
... The condition usually accompanies neurasthenia and hysteria
and is an exceedingly rare affection. Cases have been described by
Schütz, Cohn and others in which antiperistaltic movements have

been noted. The affection occurs more commonly in men and in those who are in middle life.

Symptoms and Diagnosis.—The most important symptom is the noting of violent visible movements of the stomach in an organ in which pyloric obstruction does not exist. These waves run downward from the costal margin toward the median line, and in the 4 neurotic cases I have observed it occurred to me that they had a higher and more active wave than is ordinarily seen in pyloric obstruction, in which condition they are seen about 6 in number to the minute. This visible peristalsis is often accompanied by like movements in the intestine (the latter of which, however, are not so plainly visible as those of the stomach), more or less loud rumbling which in a thin abdomen may be audible at a distance, and crampy sensations that are felt by the patient. Examination of the case may show a stomach which empties itself too quickly or normally, and fluoroscopic observations with bismuth plainly show the wild gyrations of the organ. With these, subjective symptoms are often present, prominent among which may be mentioned eructations, nausea, anorexia, sinking sensations in the stomach, constipation or diarrhea, and also those of neurasthenia (depression, lassitude, loss of energy and the vasomotor disturbances). Examination with the test-meals may show any degree of stomach secretion at the one time, but more or less variation (as is described in neurasthenia gastrica) in the running way. In making a diagnosis, stenosis of the pylorus, above all, must be excluded, and this is easily done by examination with the stomach-tube, the X-rays, and the observation of the case.

Treatment.—If a marked or moderate degree of true pyloric stenosis is believed to be present the case is an operable one. If not, treatment directed to the neurasthenia must be instituted according to the degrees of this condition. Excessive amounts of outdoor exercise serve to good purpose in the moderate cases, this being portioned off into certain definite times during the day. Retiring early and the hydropathic treatments are also efficient. Occasionally, intragastric faradism or stomach lavage with rather cool water answers well in the routine. The diet should be bland yet abundant in all kinds of food, and small-sized meals at regular intervals answer the best. General tonics or hematic tonics in the anemic should be given in all cases. The stomach symptoms are best controlled with the use of large-sized doses of bromides and valerian, and these should be given an hour or so before meals, and the tonics after. Belladonna and codeine may also be employed in selected cases. The bowels must be kept well open, preferably by the use of simple or laxative measures.

ANTIPERISTALTIC RESTLESSN

Cases of this condition, which probably are
taltic unrest, have been described by Glax, Schüt:
the waves pass from right to left. Cannon has
to be an important motor phenomenon of the la
his observations it seems reasonable to suppose
conditions after the intestinal contents empty frc
the ileocecal valve into the head of the colon,
carried onward for some distance, certain ant
the colon then carry a portion of the food ba
establishing a sort of circulation in the ascending
of the large intestine probably has to do with tl
food elements into the portal system. From
peristaltic contractions move the contents onwa
colon and rectum, where the residue collects a
antiperistaltic restlessness of neurotic origin it
movements originate in the intestine, passing up
In neurotic cases, when the abdominal walls are
unusual to observe quite vigorous peristaltic mo
tine, passing in various directions, but not exis
Cases of antiperistaltic restlessness must be differ
or intestinal stenosis and conditions of abdor
treatment outlined in peristaltic unrest also ansv

PYLORIC INCONTINENCE.

Attention was first called to incontinence o
pylorus by de Séré. The pylorus may be incom
pyloric neoplasms, or from traction of intern
adhesions. The condition may be due to chronic
of the atonic types, and it is not uncommon to
pensatory activity of the pyloric muscle in low st
such as accompany continued fever or chronic wa
also probable that the pylorus becomes relaxe
stenosis from any cause, and in cases of exc
neurotic type of affection has been described in
pylorus fails to prevent the chyme from emptyi
at a too rapid rate. Much has been written on t
simple or neurotic type, yet there is no doubt tha
rare affection. My experience has been, even i
primary atony in which one would suppose tha
also be relaxed, that this is only very seldom so.

to be considerable doubt as to the probability of this condition there is some reason to believe that it can occur. In my experience with several cases in which the gastric analyses would logically suggest an incontinent pylorus I have always observed that hypermotility of the organ existed counting for the absent or low stomach findings.

Of the symptoms described there are those of gastric distress of no definite type, constipation, insomnia, abdominal distention and neurasthenic symptoms. The diagnosis is suggested by finding an empty stomach soon after meals, with bile present in the full as well as the empty organ. On inflation it is said that the air rushes into the intestine causing a quick general tympany while that of the stomach soon disappears. I agree with Ewald and Einhorn in that this is a fallacious method of examination. Even in cases of marked atony and dilatation, air begins rushing into the duodenum within a few moments after its introduction or generation within the organ. In other cases again, even in extreme distention, confinement in the stomach is marked and persistent. It has often occurred to me that the quicker the stomach is distended and the fuller it is, the less is the liability that the air will quickly escape. It seems as if the extreme distention causes a closure of both sphincters, a condition that could not exist in pyloric incontinence. In 4 cases in which from the findings of rapid evacuation and constant presence of bile in the organ would lead one to the diagnosis of pyloric incontinence, in each instance I have observed a hypermotility present, was successful in obtaining sharp enough radiographs to show the pyloric grooves above and below (closed pylorus), and was able to distend the stomach so that quick escape was not noted; therefore, I have looked upon these as instances of hypermotility of the externally invisible form. So it is that one should be careful in making the diagnosis from only moderate inflation and test-meal extractions without further examination. Furthermore, the presence of bile and pancreatic secretions in the stomach, whether fasting or full, or when the secretions are observed in the lavage water, are most common findings in other cases even those in which delay of the exit of food for no obstructive reason may be observed.

The treatments that have been advised are the use of finely subdivided solid foods, frequent small meals, intragastric faradism, strychnine, postural treatments, and that for a neurasthenia.

DUODENAL REGURGITATION DUE TO FATTY FOODS.

Recently the author has drawn attention to a condition giving marked gastric symptoms due to the taking of fatty foods and oils.[4]

The condition may be referred to as a clinical en
pathology, and is of importance because of the g
oils and fat-bearing foods in the treatment of gas
the present time, the cases in which the use o
contraindicated are those of so-called fat intol
fat digestion and absorption and a difficulty to
absorption are present. There is, however, a
which such fat foods as milk, fresh cream, butt
native oils are distinctly harmful to employ in a
for the establishment of the condition in the f
its perpetuation afterward should their employn

The main symptom in these cases is a shar
tric pains, radiating to the back, which come o
sisting for from several minutes to several hour
days at a time. The pains may be severe enou
patient for the time being, and when absent, wl
the individual is as well as ever. The gastric d
of meals and the ingestion of any particular ki
sionally, nausea is present during the seizure
The condition occurs in the middle aged, and the
of the stomach and abdomen is negative. Mor
tress from anxiety and suffering is present when

The gastric analyses show a large return a
in one of my cases being 900 cubic centimeters
deeply bile stained, contains considerable floa
much pancreatic juice, hydrochloric acid in larg
haps mucus from stomach irritation. The empt
even in the mornings, shows a large accumulati
tions, fat and fatty acids, mucus, and perhaps sm
chloric acid, the entire return in one of my ca
cubic centimeters. During the paroxysm of
invariably contains the above accumulation, it l
much less so when the patient is pain free or w
fat-free diet for several days.

In the production of the condition it is imp
Pawlow in his experiments upon dogs having a g
an emulsion which contained bile and pancreat
hours after the ingestion of oil. Volhard, follow
that in the human stomach positive results in t
regurgitated fluid containing trypsin following
could be obtained in 60 per cent. of cases. Upo
the Levinsky method (giving half a teaspoonf

twenty minutes before the oil and another twenty minutes afterward to neutralize the acidity of the stomach contents), and the Koziczkowsky method (using cream instead of plain oil) for obtaining specimens of duodenal secretions from the stomach following the giving of an oil were based; and I may parenthetically state that the latter two methods are to be preferred for obtaining specimens of duodenal secretions for examination to the two recently advanced mechanical means.

The condition is probably brought about by the normal pyloric reflex being interfered with permitting of regurgitation, either by there being a diminished secretion of hydrochloric acid (which, according to Cannon, activates this reflex by stimulation of the duodenal mucosa) by the fats and oils, or, as seems more likely, by the fatty foods or oils in some way directly affecting the mucosa of the pyloric region of the stomach and the pyloric muscle and causing relaxation or permitting of regurgitation in that way. The pains in these cases are due to a collecting of the regurgitated juice in the stomach, this causing the formation of the fatty acids from the oils and fats, and these with the bile causing stomach irritation. These cases rapidly recover when a fat-free diet (skimmed milk, white of eggs, carbohydrates, green vegetables, salads, boiled meats, etc.) is instituted without any further forms of treatment. The condition must be diagnosed from those instances of test-meal extractions in which bile is noted in the stomach (these test-meals contain only small amounts and usually are of no practical importance), from gastrosuccorrhea (in which instances the pains are not so severe, no duodenal secretions are present and if so only in small amounts, the mucous content is lower and the hydrochloric acid is higher), and pylorospasm. The best means for differentiation as well as diagnosis of the condition is by means of gastric analyses, and the diagnosis should not be made unless the patient had been taking these foods, and the characteristic findings in the test-meals and the aspiration of the fasting stomach are present.

References.

[1] Braun and Seidel: Mitth. a. d. Grenz. d. Med. u. Chir., 1907, xvii, p. 533. Progressive Medicine, no. xl, p. 47.

[2] Plummer: Journal American Medical Association, August 15, 1908.

[3] Bassler: "Singultus Gastrica Nervosa," N. Y. Medical Journal, 1910.

[4] Bassler: "Duodenal Regurgitation Due to Fatty Foods and Oils as a Clinical Entity. Fat Intolerance of Gastric Origin," N. Y. Medical Journal, 1910.

[illegible] the Gastro-enteric

[illegible] deration of the common forms [illegible] to general practitioners of [illegible] honored classifications which [illegible] tion, secretion and motility of [illegible] se cases which most plausibly [illegible] of tissue as reasons for their [illegible] lines of rather ordinary clinical [illegible] be quite impossible here to accom- [illegible] the subject already presented, and [illegible] that is important, although I shall [illegible] upon the etiology of the common [illegible] ing this some of the extra therapeutic [illegible] and not consider detail work in the way [illegible] agnosing of gastro-enteric affections.

[illegible] ses of the digestive canal are seen in [illegible] care for themselves and others, and young [illegible] many activities of life. In the child and those [illegible] e neither are exempt from the neurotic con- [illegible] ganism of the body is less assailed or impres- [illegible] ment of neurotic states in the first, and waning [illegible] less activity of life, baneful effects from them, or [illegible] comes from years and experience, grant some- [illegible] unity to the second. In these two extremes of life [illegible] bances are more commonly due to dietetic errors, and [illegible] this, in those past middle life, to organic or malignant [illegible] All this means that the neurotic disturbances are most [illegible] among those whose physical as well as whose mental [illegible] rule in the nation, state, business and home. Consequently [illegible] these cases are found mostly in those between the twentieth [illegible] ieth years of life, in men somewhat more so than in women, [illegible] for reasons of the more bitter complaining and sensitiveness

of the female sex and the more time they have at their disposal, the women folks make up the majority of the slight and medium cases that we see.

The first questions that must be answered to one's self in the care of these conditions are: Is the condition distinctly due to reasons causing direct error in digestion? or, Is the origin of the condition situated in the general system, and, because of the sensitiveness of the digestive tract to these, they here mainly manifest themselves? or, Is there present a combination of these two? The practical side of handling these cases as they clinically present themselves hinges upon these points, for, whatever the aspect of the case may be, permanent results to be obtained depend more upon finding the cause than upon applied fine points of therapeutic detail in the symptomatic way. These three crucial points can only be, and almost always are, obtained by the taking of a complete history, and the complete examination of the patient.

In the first, or local reasons, we deal with factors which from irritating circumstances generate abnormal impulse either in kind or in exaggeration of those present in normal digestion. Plainly such disturbances could only ensue from dieteto-hygienic error connected with the ingestion of foods or drink, as these may cause alterations in the normal physiology of digestion. Such are seen in those cases in which, for chemical, mechanical, or thermal reasons, irritation has been applied to the gastro-enteric mucosa, affecting nerve impulse in unfavorable ways so that these are brought within the cognizant sensibilities of the subjective sense. To etiologically delineate such, it may be said that they are found in hasty eaters (which means incomplete mastication, salivation, and often overfeeding); in those who partake largely of irritating foods, such as highly spiced, corned, improperly prepared, heavy meat, onion, or garlic users; the drinkers of much iced or too hot fluids; the intemperate use of alcohol, coffee, tea, or tobacco; and in those who eat in quantity or kinds beyond the digestive power present in debilitated or fatigued states of body. In a normal individual, when these abnormal factors have been long enough existent, gastro-asthenic states ensue in the way of disturbances of the acid-enzymotic secretion, motility, or sensation of the stomach and as these may unfavorably secondarily affect intestinal digestion. Logically, when such improper habits are stopped, if they have not existed long enough for the development of organic change in the glandularis, digestion returns to a more normal condition. Medical measures of substantial benefit may materially shorten the time this takes. Among such of practical worth are the use of alkalies

and belladonna in hypersecretion, the more fluid and bland diets in hypermotility, the nerve sedatives in hypersensation, etc.

In considering the subject of digestive neuroses which have a primary or more important seat in the general body, a much broader and interesting field of factors is encountered. For the primary understanding of these, all irregular processes pertaining to the general body must be viewed as a cause manifesting its main force upon the most vulnerable point of the human economy—the gastro-enteron. In broad divisions I will consider these under the headings of nutritional, toxic, reflex, and psychic causes, since also into these groups they may be clinically divided.

The nutritional neuroses are those digestive disturbances which ensue from abnormal states of nutrition of the general nervous system. Such abnormal states could develop from habitual insufficient intake of food, deficient absorption of same, low vitality states from excessive physical or mental work, or abnormal katabolic conditions of the general system. Naturally in these, for many cases which appear mainly nutritional, toxic causes must also be figured in the make-up of factors. But since clinically, and rightful deduction from results in therapy, the nutritional side deserves first consideration, and because for the best results in the treatment of the case, the toxic causes may be considered as of secondary importance.

In many "dyspeptics," in men who are too busy to eat, and women who eat freakishly, or those who diet themselves for relief of symptoms, states of subnutrition are common. It is often a difficult matter to diagnose such states of underfeeding in any definite way, because in appearance many of these patients look quite well nourished and such a condition might not be suspected until you obtain history details of the quantities, time, and quality of food that is customarily partaken of. In this group of cases it is an interesting fact that the subjective symptoms usually become worse and worse the more stringently they diet themselves for its relief. A plainer type of these cases is seen in those who are convalescing from acute febrile disease, in which, because of the effects of fever upon the body and the low feeding at the time, a legacy of subnutrition is left. The great accompaniment of most of the clinically seen cases is an underlying neurasthenia, and to what cause such constant expenditure of nerve energy beyond its supply may be due to always deserves first consideration in each instance. Remembering that in neurasthenic states it is of first importance to remove the exciting cause of the condition, a subdivision to analyze the etiology present must be made if possible between the primary and secondary neurasthenias—that is, between

those of excessive expenditure of nerve energy and those of deficient supply of same. While this is important in the detail of therapy, all of such patients should be looked upon as subnourished, since higher nutrition kept up over a length of time brings about the best clinical results in the end. The same is also true in the cases of the common forms of simple anemia. It is true that many of these latter are of toxic origin, but for the relief of the picture as a whole the establishment of higher states of nutrition is essential. It has always appeared to me that the less the degree of anemia, the less the benefit derived from the hematinic tonics, and the more is derived from the generally constructive dietetic measures. In all of these conditions the employment of higher caloric feedings by supplemental meals to the quantities then taken, and the severe curtailment of those of the latter which are of little or no benefit in the nutritional way are measures of much importance. Lastly, it must be mentioned that, in catarrhal or ptosed states of the abdominal organs, neuroses often develop which are benefited most when the subnutritional picture is kept in mind along with the other indicated measures of treatment.

The toxic factor in producing gastro-enteric neuroses is a subject almost as large as medicine is broad. That the toxins of certain infectious diseases and intoxications from the intestinal canal have, by their toxins, a marked effect on the functional status of digestion is almost of daily observation. Briefly, one can draw attention to the following as fruitful causes—gout, rheumatism, uric acid diathesis, malaria, syphilis, grippe, typhoid, diphtheria, the pyogenic affections, tetanus, pneumonia, pregnancy, fermentative and putrefactive states of the intestinal canal and so on. Plainly does the hand of logic point to the removal of any such primary source of toxins before much could be expected in the relief of the gastro-intestinal symptoms. But there is a group of cases about which a few extra words would not be amiss, and they are the instances of milder toxic conditions found in those in whom definite disease does not exist, and who are well enough to be about. This type makes up a bulk of our office and our clinic cases of toxic neuroses. There is little doubt to-day that the saprophytic and pathogenic organisms found normally in the digestive tract could, under favorable conditions for their proliferation, generate toxins, which, gaining the circulation, cause the development of subjective symptoms in the digestive canal. While these, therapeutically in so far as neuroses are concerned, occupy a subsidiary rôle to the primary condition making possible their origin, how many are the cases that we see which clinically are just clean-cut neuroses and for which condition they come under observation? Over nine-

tenths of the food is absorbed in digestion, and the larger portion of the remainder is residual in feces of which from a third to one-half is composed of bacteria, which further act putrefactively upon it in the lower colon. In the normal individual it is not the antiseptic properties of the digestive juices (which are mild), but the rapidity of the processes of digestion and absorption and the brief stay of the residue in the tract that prevent the possibility of toxin resorption. Now when these processes are delayed or interfered with, greater is the chance for bacterial action and toxemia, and such is the common state of affairs in those who are habitually constipated. Let us not lose sight of one of the main etiological factors producing a large number of diseases of the nervous system (migraine, neuritis, neuralgia, neurasthenia, psychoses, melancholia and others), and consider that if these could come from such gastro-intestinal origin, then constipation, excessive generation of aromatic substances, occasional acetonuria, and the like, may cause many of our "nervous dyspepsias" as well, for functional change comes before organic. In this same light let us not overlook those, who, from necessity or choice, live sedentary and indoor lives, and therefore develop results from suboxidation, obesity, surfeit breathing of carbon dioxide, or other polluting gases into the circulation. We must never forget that it requires about 2000 cubic feet of air to pass daily through the lungs of an adult in order to furnish enough oxygen to maintain good digestion, and that physical exercise in the open does much to enhance more thorough oxidation of the body tissues.

Of late years, largely through workers in the special fields of medicine, the reflex neuroses are commanding more and more attention. Exactly how such effects are brought about is still somewhat of a question, to which, as logical reasons for the understanding of their development, are the facts that, viewing the body as a whole, a disease or marked pathological disturbance in any organ outside of the digestive canal acts as a chestnut-burr irritant in throwing over the normal nervous balance of the neurological system, and that these abnormal stimuli manifest their effects most easily upon the digestive organs, which, through abundant sympathetic supply, delicate and complex functions, are most sensitively balanced. Almost daily, surgeons, ophthalmologists, gynecologists, and others, are contributing reports of cases of this kind in which the removal of the primary cause restored digestion to normal standard. To these we must give respectful attention, although it must not be forgotten that moral influence from special treatment of such other conditions, and the better general state of body and nervous system ensuing from same,

may cause restoration without considering such in the strict nerve-reflex sense. In a broad and abundant experience with gastro-enterological conditions, I freely confess to still having many uncleared doubts on this subject, but it seems logical to believe that such neuroses do occur in some nervously inclined or undernourished individuals. It is one of those subjects which can be argued from two sides, in which, the lack of accompanying digestive symptoms in the great majority of outside pathological conditions, workers in the other departments of medicine cannot answer for, and the multiple organ pathology found in many patients who come under the observation of the gastro-enterologist enshrouds him with many unanswerable questions. It is a subject which can best be worked out by the gastro-enterologist alone, and he must be of good understanding and practical in broad medicine. I am of the opinion that a proportion of our neuroses cases rightfully belong to others for best treatment. Still, without worked-out statistics to substantiate me, it must be said that of the thousands of neuroses that I have seen, but few indeed have been absolutely and singly cured of digestive disturbance who have also been treated by others skilled in the special fields to which such cases, for other existing conditions, also belonged. And I would here advance the admonition to the surgeon, ophthalmologist, gynecologist, and others, to be somewhat more guarded than is common to-day in promising cure of all digestive conditions after such errors as he had found and treated had been corrected. The majority of all cases are not, and he should never forget that most of the gastro-intestinal cases seen are *bona fidely* due to internal medical conditions, and not always to such as chronic appendicitis, gall-stones, gastric ulcer, eye-strain, and endometritis. It is surprising how many persons wear glasses, have been operated upon for other existing conditions, or treated and discharged cured, who continue to come back for treatment for a digestive disturbance the relief of which had been promised by the other. Of course, when disturbance is found in other organs of the body, it is the internist's duty to his patient to have instituted means for its cure or alleviation.

To encompass in a few words the interesting subject of psychic gastro-enterological neuroses is beyond me. When we deal with perversion states in the minds of others, we deal with effects from conception and perception, mental habits, inheritance and early training, physical and mental environments and education, his hopes, fears, ambitions, disappointments, worry, grief, suspense and anxiety. To understand how all of these may affect the body, and the digestive tract in particular, we need only to analyze moments of our own

lives in the past, those of others about who are dear to us, and, with a knowledge of the researches of Cannon and Pawlow, to understand the power in the functional way of the brain over the body. Need I dilate upon the commonly seen symptoms of cessation of digestion, spasms of the cardia and pylorus, anorexia, nausea, diarrhea or vomiting from emotional reasons? Here again is the ever-ready sensitiveness of the digestive tract. Often in a patient before us, mental habits, environments of life, domestic and business worries hide deep in the case of true neuroses. His manner, his pupils, and his knee-jerks do not manifest their presence, and bad effects from what he thinks and feels do not always mean the presence of neurasthenia, hysteria, hypochondria, or psychasthenia. Ambition is a far-reaching hand from a body not always equal to tolerate its disappointments and domestic worries are not always for public information. In our day and land, contented minds are not common among the active. The lost opportunities and hard blows of the past often live as virulently in our minds to-day as in the moments of long ago. We are not all mentally broadened by education of intuition. The pleasures of home life are often mixed with sore trials, and business does not always run the way we believe or hope it should. In these instances of cases we are not arbiters of the universe with power to correct troubles for the individual, nor does drugging such patients meet the heights of rational medicine. We need more lasting and satisfying aids, and these must be found in pure human direction, assurance, kindness, gentleness, non-morbid sympathy, and appealing treatment. Now, what the latter in each case should be is always much of a gamble. As the mental analysis of the case may be, our manner at the time, and how we approach its treatment, make, with the use of the same therapeutic measures, great differences among us. It is in these cases that the personal equation of the physician in the way of instilling confidence and enthusiasm in his patient is a strong factor for results. They should never be overtreated, or too lightly handled, for both are sorrowful measures. There is residual suggestion enough in the artful physician to meet most of these cases, to which it may be said as a strong moral agent is the employment of electricity. I believe that the day is past when we should always be on the search for organic or malignant disease, and be indifferent to those that do not belong to these groups. As physicians we must accept the duty of treating human illness in all its phases. We have learned from the therapeutic vagaries and creeds, which, in the past, have cured or relieved many of these cases for us. To them we owe a thanks for teaching us to see lower, and in their psychotherapeutic measures, born of ignorance in

medicine as they are, they are of that much more appealing mystery and strength to these susceptible individuals. We need not pray with these patients, but let us in some of our idle moments view the human being abstract to regular medicine. View him as an individual altogether within himself. Thoughts will then come to us which will make possible the improving of our patients and ourselves still more materially, and we need not go outside of legitimate paths of medicine to employ the means. For, of every functional case that these fads have cured, there are a thousand which general practitioners of medicine in a silent manner have cured in somewhat the same way, although some physicians may not know or feel it as such. To get down to the human being as he exists is no idle effort on our part.

There is one therapeutic measure for most all neuroses which should be especially mentioned, and that is a sojourn in the country. In the more and better air, in new and relaxing environments away from worries of business and home, in the regular hours for sleep, the eating at special times, and the outdoor exercise, most of the subjective symptoms, the introspection, self-examination and self-pity fade away, and from this life truer to nature benefits come to the great majority of them. As the general system improves from this regular living, the gastro-intestinal tract is thereby strengthened. This in turn makes possible restrengthening of the body and this again benefits digestion, and so a charmed circle is set in motion, and the case makes progress toward substantial relief and cure.

I have tried in this brief chapter to present some of the digestive neuroses cases along rather simple clinical lines for practical application by the general workers in medicine, and in it I have taken many liberties with the field of application described in the foregoing pages, but not so many with the patient of the general practitioner. My themes apply to the average case that is seen, and, if I have served my wish that some lessons might be more simply learned, I have gained my purpose and my hope has been realized.

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